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H.R. 2152, THE INTER-AMERICAN SCIENTIFIC COOPERATION ACT OF 1989

HEARING

BEFORE THE

SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION

OF THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY U.S. HOUSE OF REPRESENTATIVES

ONE HUNDRED FIRST CONGRESS

FIRST SESSION

MAY 2, 1989

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*Ranking Republican Member.

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H.R. 2152, THE INTER-AMERICAN SCIENTIFIC COOPERATION ACT OF 1989

TUESDAY, MAY 2, 1989

U.S. House of Representatives,
Committee on Science, Space, and Technology,
Subcommittee on International Scientific Cooperation,
Washington, DC.

The subcommittee met at 2:12 p.m., in Room 2325, Rayburn House Office Building, Hon. Ralph M. Hall (chairman of the subcommittee) presiding.

Present: Representatives Hall, Packard, Brown and Walker.

Mr. Hall [presiding]. We will come to order.

I apologize for running a little late. We just had a vote, and I think I had five groups on the Capitol steps.

We will come to order, and today's hearing of course has been called to take testimony on the "Inter-American Scientific Cooperation Act of 1989," H.R. 2152, which was introduced in the House last Thursday by the Chairman of the Science Committee, Congressman Bob Roe, and I have cosponsored it. With Chairman Roe introducing it, I feel pretty good about it having a chance to have a favorable hearing, and what we are doing here today is building a record for it so that the members of the committee and subcommittee who are not here have an opportunity to read it and to be brought up on it.

Don't be dismayed by the empty chairs because we have either in the audience or at the tables here members of the committee and the staffs who will take the testimony and ferret it out for the members, and each member will have an opportunity to hear and read the testimony.

In July of 1987, our subcommittee held a hearing to review the status of our science and technology relationship with Latin America, and this hearing was followed, as many of you know, by a full committee oversight trip to five Latin American countries in January of 1988. In the National Science Foundation Authorization Act for fiscal year 1988, Congress directed the NSF to prepare a report that charted new directions for science and technology cooperation between the United States and Latin America. That report was issued in June of 1988, and we will be reviewing it in a few minutes with its authors, Stanford Research International.

This committee's activities and the SRI report pretty well confirmed that the political and economic turmoil of the past two decades have weakened the science and technology ties between the United States and Latin America and, further, as research and training opportunities in the U.S. have declined in recent years for Latin Americans, Europeans and the Japanese have rushed in to fill the gap. This erosion of U.S. involvement with Latin America I think concerns all of us, and it particularly concerns us for the loss for those of us on both sides of the border.

Despite these problems, Latin American interest in cooperation with the United States we think seems still to be very strong. Science and technology cooperation can continue to be an avenue for the U.S. to contribute to the economic development and the political stability of all of Latin America, and that is what we hope to do.

H.R. 2152, the Inter-American Scientific Cooperation Act, addresses these issues by creating the Inter-American Scientific Cooperation Program within the National Science Foundation to provide a focus in the United States Government for science and technology cooperation with Latin America.

Among the program's activities will be joint research projects; educational exchanges, especially for graduate students and postdoctoral candidates; creative financing mechanisms involving the private sector; computer linkages for communications and data exchange; information on access to scientific equipment; and promotion of programs which will utilize the unique natural environments or the unique research facilities involved.

The bill, will also address and help to reverse the downward trend in the number of Latin American students studying in the United States and will invigorate exchanges between the U.S. and Latin American universities. These exchanges and investments in our political future are very important to us. As part of the future leadership in their homelands, these Latin American students will play key roles in determining the political and the economic alliances that the region will make in the next century, and we want those alliances to be better than they have been, and the viability, I think, of the U.S. economy is almost inescapably linked to the world economy.

America no longer occupies the position of dominance it once occupied. A successful Latin American will be very fundamental to world economic growth and thus to our own growth. No other power has closer ties to, nor greater interest in, nor more influence with Latin America than the United States. Recognition of our interests and responsibilities in the region will be critical to Latin economies and governments in the short term and to our own in the long term.

[The prepared opening statement of Mr. Hall follows:]

OPENING STATEMENT

RALPH M. HALL

MAY 2, 1989

The Subcommittee will come to order.

Today's hearing has been called to take testimony on the "Inter-American Scientific Cooperation Act of 1989". H.R. 2152 was introduced in the House last Thursday by the Chairman of the Science Committee -- Congressman Bob Roe -- and myself.

In July 1987, this Subcommittee held a hearing to review the status of our science and technology relationship with Latin America. This hearing was followed by a full Committee oversight trip to five Latin American countries in January 1988. In the National Science Foundation Authorization Act for Fiscal Year 1988, Congress directed the NSF to prepare a report that charted new directions for science and technology cooperation between the U.S. and Latin America. That report was issued in June 1988, and we will be reviewing it in a few minutes with its authors -- SRI International.

This Committee's activities and the SRI report confirmed that the political and economic turmoil of the past two decades has weakened the science and technology ties between the U.S. and Latin America. Further, as research and training opportunities in the U.S. have declined in recent years for Latin Americans, EUROPE AND JAPAN HAVE RUSHED IN TO FILL THE GAP. THIS EROSION OF U.S. INVOLVEMENT WITH LATIN AMERICA CONCERNS US ALL.

DESPITE THESE PROBLEMS, THOUGH, LATIN AMERICAN INTEREST IN COOPERATION WITH THE U.S. REMAINS STRONG. SCIENCE AND TECHNOLOGY COOPERATION CAN CONTINUE TO BE AN AVENUE FOR THE U.S. TO CONTRIBUTE TO THE ECONOMIC DEVELOPMENT AND POLITICAL STABILITY OF LATIN AMERICA.

H. R. 2152, THE INTER-AMERICAN SCIENTIFIC COOPERATION ACT, ADDRESSES THESE ISSUES BY CREATING THE INTER-AMERICAN SCIENTIFIC COOPERATION PROGRAM WITHIN THE NATIONAL SCIENCE FOUNDATION TO PROVIDE A FOCUS IN THE UNITED STATES GOVERNMENT FOR SCIENCE AND TECHNOLOGY COOPERATION WITH LATIN AMERICA. AMONG THE PROGRAM'S ACTIVITIES WILL BE:

- JOINT RESEARCH PROJECTS
- EDUCATIONAL EXCHANGES, ESPECIALLY FOR GRADUATE STUDENTS AND POST-DOCTORAL CANDIDATES
- CREATIVE FINANCING MECHANISMS INVOLVING THE PRIVATE SECTOR
- COMPUTER LINKAGES FOR COMMUNICATIONS AND DATA EXCHANGE
- INFORMATION ON ACCESS TO SCIENTIFIC EQUIPMENT, AND
- PROMOTION OF PROGRAMS WHICH UTILIZE UNIQUE NATURAL ENVIRONMENTS OR UNIQUE RESEARCH FACILITIES.

UNIQUE NATURAL ENVIRONMENTS AND CONDITIONS MAKE LATIN AMERICA A CRITICAL AREA FOR RESEARCH OPPORTUNITIES FOR U. S. SCIENTISTS.

For example, to thoroughly investigate such topics as the deforestation of the Amazon basin and its contribution to global climate change and species diversity, U. S. scientists need stable working relationships with Latin American scientists and access to these environments. H. R. 2152 will target key projects of this sort for funding by the NSF.

The bill will also address and help to reverse the downward trend in the number of Latin American students studying in the U.S. and invigorate exchanges between U. S. and Latin American universities. These exchanges are investments in our political future. As part of the future leadership in their homelands, these Latin American students will play key roles in determining the political and economic alliances that the region will make in the next century.

The viability of the U. S. economy is inescapably linked to the world economy; America no longer occupies the position of dominance it once did. A successful Latin America will be fundamental to world economic growth and thus to our own. No other power has closer ties to, greater interest in, and more influence with Latin America than the United States. Recognition of our interests and responsibilities in the region will be critical to Latin economies and governments in the short term and to our own in the longer term.

Mr. **Hall**. I would recognize Congressman Packard, who is the Ranking Republican Member of this subcommittee, for any opening statement that he may want to make.

Mr. **Packard**. Thank you very much.

I certainly want to commend you, Mr. Chairman, for calling this hearing on this very important subject. Today we look forward to exploring the mutual beneficial international scientific cooperation between Latin America and the United States.

It is essential for the national security and for the economic stability of this country that strong ties exist between Latin America and the United States. Those who would dismiss the political significance of scientific and technological exchange should consider the alarm in Congress if the Soviet Union were to pursue such activity with our friends in Latin America.

Scientific and technological cooperation cannot be viewed as disassociated from other important issues between our countries—trade, energy, resources, economic development, immigration, and unemployment. Besides strengthening Latin America's infrastructure for science and technology, expanded cooperation with the United States should lead to wider practical application of scientific advances in industrial development, agricultural production, environmental protection, health care, and many, many other fields.

During the 1960s and '70s, the United States provided the resources necessary to help developing Latin American countries and their infrastructure for science and engineering. Thousands of scientists were trained largely in the United States. Unfortunately, in the mid-'70s political and economic turmoil disrupted these cooperative efforts in science and technology.

Several changes have occurred which make this an appropriate time to reinforce, to improve, and to expand the traditional ties between Latin American countries and the United States' scientific communities. Recently elected democratic governments in some Latin American countries have made the general economic and political climate much more favorable to investment than any time in the past 10 years. Many Latin American countries are establishing science and technology priorities. They are rapidly expanding cooperation with Europe, with Japan and Canada in many of their strategic fields, and an increasing number of their graduate students are being trained in Europe rather than here in the United States.

The United States can and should assist in providing the leadership necessary to the development of a strong scientific community in the Western Hemisphere.

Therefore, our subcommittee is pleased to have the opportunity today to examine ways to exhance the cooperation in science and technology between our friends in Latin America and the United States.

I want to welcome the witnesses, and I look forward to hearing their views and recommendations on this important issue.

Thank you very much, Mr. Chairman.

[The prepared opening statement of the Mr. Packard follows:]

RON PACKARD (R-CA)
OPENING STATEMENT
INTER-AMERICAN SCIENTIFIC COOPERATION ACT OF 1989
MAY 2, 1989

THANK YOU VERY MUCH, MR. CHAIRMAN.

I COMMEND THE CHAIRMAN FOR CALLING A HEARING ON THIS IMPORTANT SUBJECT. TODAY I LOOK FORWARD TO EXPLORING THE MUTUALLY BENEFICIAL INTERNATIONAL SCIENTIFIC COOPERATION BETWEEN LATIN AMERICA AND THE UNITED STATES.

IT IS ESSENTIAL FOR THE NATIONAL SECURITY AND ECONOMIC STABILITY OF THIS COUNTRY THAT STRONG TIES EXIST BETWEEN LATIN AMERICA AND THE UNITED STATES. THOSE WHO WOULD DISMISS THE POLITICAL SIGNIFICANCE OF SCIENTIFIC AND TECHNOLOGICAL EXCHANGE SHOULD CONSIDER THE ALARM IN CONGRESS IF THE SOVIET UNION WERE TO PURSUE SUCH ACTIVITY WITH OUR FRIENDS IN LATIN AMERICA.

SCIENTIFIC AND TECHNOLOGICAL COOPERATION CANNOT BE VIEWED AS DISASSOCIATED FROM OTHER IMPORTANT ISSUES BETWEEN OUR COUNTRIES--TRADE, ENERGY RESOURCES, ECONOMIC DEVELOPMENT, IMMIGRATION, AND UNEMPLOYMENT. BESIDES STRENGTHENING LATIN AMERICA'S INFRASTRUCTURE FOR SCIENCE AND TECHNOLOGY, EXPANDED COOPERATION WITH THE UNITED STATES SHOULD LEAD TO WIDER PRACTICAL APPLICATION OF SCIENTIFIC ADVANCES IN INDUSTRIAL DEVELOPMENT, AGRICULTURAL PRODUCTION, ENVIRONMENTAL PROTECTION, HEALTH CARE, AND MANY OTHER FIELDS.

DURING THE '60S AND '70S, THE UNITED STATES PROVIDED THE RESOURCES NECESSARY TO HELP DEVELOP LATIN AMERICA'S INFRASTRUCTURE FOR SCIENCE AND ENGINEERING; THOUSANDS OF SCIENTISTS WERE TRAINED, LARGELY IN THE UNITED STATES. UNFORTUNATELY, IN THE MID-'70S POLITICAL AND ECONOMIC TURMOIL DISRUPTED THESE COOPERATIVE EFFORTS IN SCIENCE AND TECHNOLOGY.

SEVERAL CHANGES HAVE OCCURRED WHICH MAKE THIS AN APPROPRIATE TIME TO REINFORCE, IMPROVE AND EXPAND THE TRADITIONAL TIES BETWEEN THE LATIN AMERICAN AND THE UNITED STATES SCIENTIFIC COMMUNITIES. RECENTLY ELECTED DEMOCRATIC GOVERNMENTS IN SOME LATIN AMERICAN COUNTRIES HAVE MADE THE GENERAL ECONOMIC AND POLITICAL CLIMATE MORE FAVORABLE TO INVESTMENT THAN AT ANY TIME IN THE PAST 10 YEARS. MANY LATIN AMERICAN COUNTRIES ARE ESTABLISHING SCIENCE AND TECHNOLOGY PRIORITIES.

THEY ARE RAPIDLY EXPANDING COOPERATION WITH EUROPE, JAPAN, AND CANADA IN MANY STRATEGIC FIELDS, AND AN INCREASING NUMBER OF THEIR GRADUATE STUDENTS ARE BEING TRAINED IN EUROPE RATHER THAN IN THE UNITED STATES.

THE UNITED STATES CAN AND SHOULD ASSIST IN PROVIDING THE LEADERSHIP NECESSARY FOR THE DEVELOPMENT OF A STRONG SCIENTIFIC COMMUNITY IN THE WESTERN HEMISPHERE.

THEREFORE, OUR SUBCOMMITTEE IS GLAD TO HAVE THE OPPORTUNITY TODAY TO EXAMINE WAYS TO ENHANCE THE COOPERATION IN SCIENCE AND TECHNOLOGY BETWEEN OUR FRIENDS IN LATIN AMERICA AND THE UNITED STATES. I WANT TO WELCOME THE WITNESSES, AND I LOOK FORWARD TO HEARING THEIR VIEWS AND RECOMMENDATIONS.

THANK YOU.

Mr. **Hall**. Thank you, Mr. Packard.

We have an outstanding panel—two panels here today, and on panel 1, Ms. Catherine Ailes, who is Director, Science and Technology Policy Program, SRI International, and I am told was chief writer of their report, "New Directions for U.S.-Latin American Cooperation in Science and Technology." Ms. Ailes, we are honored to have you, and if you would come and have your place over here to the left of Dr. Boright.

Dr. Boright, who is Director of International Division of the National Science Foundation, here in Washington, D.C.

We are extremely pleased to have you all. What we will do is let you testify almost any way you want to. I suggest that you just briefly state that you have, and without objection from any of the committee, we will put your entire statement in the record for all the rest of the members to read.

But at this time, chivalry overtaking me, we will recognize Ms. Ailes first.

STATEMENT OF CATHERINE P. AILES, DIRECTOR, SCIENCE AND TECHNOLOGY POLICY PROGRAM, SRI INTERNATIONAL, ARLINGTON, VA

Ms. **Ailes**. Thank you, Mr. Chairman.

I do have a formal statement that, with your permission, I would like to submit for the record.

Mr. **Hall**. Without objection, you do as you please.

Ms. **Ailes**. Thank you.

Mr. **Hall**. We are too honored to have you to question the way you are going to present your testimony.

Ms. **Ailes**. Thank you very much.

I thank you for inviting me to testify today concerning the proposed Inter-American Scientific Cooperation Act of 1989.

As you know, in December 1987 the National Science Foundation, together with the Department of Energy and NASA, asked SRI to conduct the independent interagency study of "New Directions for U.S.-Latin American Cooperation in Science and Technology" that had been called for by the Congress in the 1988 authorization acts for NSF and NASA.

I would like to begin with a brief overview of the study and the findings of the study, particularly as they relate to the proposed legislation.

Cooperative programs in science and technology between the United States and Latin America have operated for many years at both the governmental and nongovernmental level and in both bilateral and multilateral forms.

During the 1960s and 1970s especially, the United States played a major role in developing Latin American S&T resources. Large numbers of scientists and engineers were being trained in U.S. institutions. Several cooperative linkages had developed between U.S. and Latin American research institutes and universities, and AID was funding significant S&T projects in various countries.

Institutional development as well as infrastructural improvements were occurring at a relatively healthy pace, and the United States was an instrumental partner in that growth.

By the late 1970s, however, a subtle shift had begun to occur. Many Latin American countries had surpassed the level of GNP per capita required to participate in bilateral AID activities, thereby reducing direct U.S. involvement significantly.

At the same time, political unrest in the region intensified, causing many scientists to leave their home countries, and local resources for research and development began to shrink while support for key S&T institutions weakened.

In more recent years, the S&T environment in Latin America has begun to stabilize with the reestablishment of democratic governments in many nations, the return of numerous scientists who left during the period of political turmoil, and the resumption of civilian control over many scientific and technical agencies.

Domestic investment in S&T has increased, and the research portfolios of many countries have seen shifts towards an emphasis on the development of technologically applicable areas of research that are characteristic of many of the newly industrializing countries.

Although constrained by resource problems, Latin America has been able to obtain a level of significant accomplishment and visibility in the international research community. Intra-regional forms of S&T cooperation are emerging and European countries and the Japanese, recognizing the potential of Latin America as a market and trading partner, have been increasing their S&T efforts as part of their expanded involvement in the region.

The United States, however, has not yet followed suit. The U.S. Government does continue to be involved in numerous science and technology-related activities in Latin America through a variety of cooperative science programs and projects supported by the National Science Foundation and other federal R&D agencies, as well as development-oriented assistance programs of AID. Professional societies and private foundations, too, promote cooperation, although sometimes on a modest level.

Nevertheless, available evidence points to a continued decline in the long tradition of science and technology interaction between the United States and Latin America. Few fellowships or other forms of financial assistance are any longer available for Latin American students wishing to come to the United States for higher education, and the number of such students has declined steadily since 1982. Although total dollar figures are not available, eligibility for AID funding has diminished substantially and the number of NSF grants for activities involving Latin America flattened out in the mid-1980s.

If the United States wishes to reverse these trends, what are the most promising areas in which to invest in cooperation with Latin America?

The SRI study as a whole focused on basic research and engineering, with an emphasis on the five most highly developed Latin American countries in terms of science and technology activity—Argentina, Brazil, Chile, Mexico, and Venezuela—but also considering specific opportunities for cooperation throughout the region.

The rationale for this focus was twofold:

First, while a number of previous or ongoing studies had emphasized the application of technology for development purposes in

Latin America, basic science and engineering, which can serve as the foundation for technological development, did not appear to have been examined in any comprehensive way. Moreover, in most countries, governments play a strong role in the support of research in basic science and engineering, while the private sector represents a more significant player in the development of technological applications.

Thus, the second consideration was based on general NSF and mission-oriented agency requirements as well as the interests of the U.S. scientific community that international cooperation be carried out on the basis of mutual benefit.

In terms of prospective disciplines for mutually beneficial cooperation with Latin America, the importance of several fields stood out—astronomy, biology, geosciences, physics, materials science and engineering.

For astronomy, biology, and the geosciences, cooperation with Latin America is central to the advancement of the field ,through access to unique environments, features, or instruments that are in specific locations. The importance of Southern Hemisphere astronomy, Latin American capabilities in space science and remote sensing, environmental concerns, the biodiversity crisis, natural resource problems, and the emergence of earth systems science represent significant overlapping reasons for encouraging collaboration with Latin America in these fields.

The other two priority fields identified—physics/materal science and engineering—represent areas that play an important role in technological development and economic growth.

In each of the five priority fields, we identified major centers of excellence and significant ongoing activity in Latin America that would represent opportunities for enhanced cooperation with the United States.

Our study also generated a number of recommendations regarding modes and mechanisms for scientific cooperation with Latin America that are likely to be most useful. Our recommendations fall into six main categories—human resources development, particularly through graduate and post-doctoral fellowships, exchanges of researchers, such as those conducted under the existing NSF-administered bilateral agreements in the Science in Developing Countries Program, laboratory equipment, instrumentation, and maintenance, libraries and journals, and outreach programs to increase awareness among Latin American scientists of the available opportunities for cooperative activities with the United States.

The need for initiatives in each of these areas is addressed in the draft bill. Wider dissemination of materials regarding cooperative opportunities, however, which is mentioned in the proposed bill only in terms of advanced study, might usefully be expanded to include reference to research opportunities as well.

Mr. Chairman, in conclusion, I would like to state that the provisions contained in the legislation currently under consideration are supported by the overall findings of the report we prepared for NSF, NASA, and DOE last year in response to Congressional directives.

Many individuals representing the U.S. scientific community, U.S. Government agencies, multilateral organizations, and private sector organizations and associations were consulted in the preparation of that report and contributed to its overall findings.

The outpouring of documents, information, and encouragement from Latin American government agencies and research institutions in response to requests for information during the conduct of that study indicates a positive attitude in the region toward a renewed U.S. interest in opportunities for S&T cooperation.

Science and technology are inextricably linked to long-range U.S. concerns in Latin America ranging from trade issues and the development of markets to matters dealing with the preservation of the environment and development of natural resources to immigration patterns and Latin Americans' relationship to U.S. national security.

A continuing decline in S&T ties between the United States and Latin America could represent a loss of influence with the technical sector of an industrializing region that could have significant ramifications extending far beyond the decade leading to the year 2000.

In the absence of U.S.-sponsored opportunities, the important role that science and technology are being given in national development plans means that countries in the region will become increasingly involved with other training and S&T programs offered by Europe and Japan.

Mr. Chairman, I commend this subcommittee for its legislative initiative and appreciate the opportunity to appear before you today.

[The complete prepared statement of Ms. Ailes follows:]

TESTIMONY OF
CATHERINE P. AILES
DIRECTOR, SCIENCE AND TECHNOLOGY POLICY Pk
SRI INTERNATIONAL

BEFORE THE
SUBCOMMITTEE ON INTERNATIONAL COOPERATION
SCIENCE, SPACE, AND TECHNOLOGY COMMITTEE
U.S. HOUSE OF REPRESENTATIVES

MAY 2, 1989

Mr. Chairman and members of the Subcommittee, my name is Catherine P. Ailes and I am the Director of the SRI International Science and Technology Policy Program. I am accompanied by Paul A. Laudicina, Vice President--SRI Washington, and Executive Director of SRI's Policy Division. As you probably know, Mr. Chairman, SRI International is a large nonprofit science- and technology-based research and consulting organization headquartered in Menlo Park, California. SRI's Policy Division, however, of which the Science and Technology Policy Program is one part, is based in our Washington operations office in Rosslyn, Virginia. Thank you for inviting us to testify today concerning the proposed "Inter-American Scientific Cooperation Act of 1989."

In December 1987, the National Science Foundation, in conjunction with the Department of Energy and the National Aeronautics and Space Administration, asked SRI International to conduct the independent, interagency study of new directions for U.S.-Latin American cooperation in science and technology called for in the 1988 Authorization Acts for NSF and NASA originating from the House Science, Space, and Technology Committee. Mr. Chairman, you asked that I provide general comments on our June 1988 report, entitled "New Directions for U.S.-Latin American Cooperation in Science and Technology," particularly as it relates to the legislation currently under consideration by the Subcommittee. I would like to begin with a brief overview of the study guidelines, scope, and methodology, and then focus more specifically on our findings regarding the level of U.S.-Latin American cooperative scientific activity, both currently and in the recent past, and opportunities for increased cooperation, including the scientific disciplines and the kinds of activities in which investment would be most productive.

STUDY OVERVIEW

Guidelines

The guidelines for the study as specified by the full Committee were quite broad. It was directed that the study examine current activities, evaluate the effectiveness of different mechanisms for cooperation, and suggest appropriate new actions, federal and non-federal, to further enhance intercontinental collaboration in science, space and technology. Further, the Committee stated that "The study should examine opportunities, identify priority countries and fields of action, and recommend, where appropriate, mechanisms--bilateral, multilateral and private--which have been effective in the past (providing reasons why they were effective), as well as those which have promise in the future."

Scope

It was necessary to establish certain parameters limiting the scope of the study while meeting these guidelines. Specifically, it was determined that the study should focus on basic research and engineering, emphasizing the five most highly developed Latin American countries in terms of science and technology activity--Argentina, Brazil, Chile, Mexico and Venezuela--but considering specific opportunities for cooperation throughout the region. The rationale for this focus was two-fold. First, while a number of previous or ongoing studies had emphasized the application of technology for development purposes in Latin America, basic science and engineering, which can serve as the foundation for technological development, did not appear to have been examined in any comprehensive way. The second consideration was based on the interests of the U.S. scientific community, as well as general NSF and mission-oriented agency requirements that international cooperation be carried out on the basis of "mutual benefit." At the same time, we thought it important not to construe "mutual benefit" too narrowly. Immediate scientific or even longer term technological gains are but one positive aspect of productive cooperation. Of equal or greater importance are the long-term gains in terms of trade, economic growth, political and cultural ties, and national security.

Approach

In conducting the study, SRI used a multidimensional approach:

- Interviews were held with representatives of U.S. Government and private sector organizations to obtain an overview of the principal ongoing programs, mechanisms, and experiences regarding the effectiveness of the various types of activity that have been undertaken;
- A survey was conducted of some 250 U.S. scientists who have collaborated with Latin American researchers or institutions to obtain their views on strengths and weaknesses in science and engineering in individual Latin American countries and modes of cooperation that have proven to be most effective in the past;
- Analyses of S&T policies and priorities, infrastructure, and R&D expenditures and personnel in Latin American countries were conducted, and data were assembled on trends in the number of Latin American students at U.S. institutions;
- Quantitative assessments of research activity were developed to assist in the identification of fields and institutions in which Latin American science is particularly strong;
- Panels of experts comprised of U.S. scientists with experience in the region and, where possible, scientists from Latin America were convened to assess Latin American strengths and potential in selected fields;
- A final review meeting of representatives of interested U.S. Government agencies, private sector organizations and S&T policy groups in Latin America was convened to review and augment the preliminary study results and overall recommendations.

For each study component, retrospective data and information on recent trends were analyzed with a view toward likely future directions and developments and their implications for U.S. initiatives and research cooperation with Latin America over the next decade.

While responsibility for our conclusions and recommendations rests with myself and my co-authors at SRI, I would like to take this opportunity to commend to you the many people who contributed to this multidimensional approach.

As an appendix to this testimony, I have included a list of those who participated in planning sessions, panel meetings, and final review of the study results. Their ideas and assistance were a necessary and invaluable part of accomplishing the study goals.

U.S.-LATIN AMERICAN COOPERATIVE SCIENCE ACTIVITY

A Tradition of Cooperation in Decline

Cooperative programs in science and technology between the United States and Latin America have operated for many years, at both the governmental and non-governmental level and in both bilateral and multilateral forms. During the 1960s and 1970s, especially, the United States played a major role in developing Latin American S&T resources. Publicly funded government programs such as the development assistance projects of the Agency for International Development, bilateral science agreements administered by the National Science Foundation, and problem-oriented cooperative projects of mission-oriented agencies such as the National Institutes of Health, the National Aeronautics and Space Administration, the Department of Energy and others were instrumental in such developments. Programs administered by private U.S. foundations and professional associations such as Rockefeller, Tinker and the American Association for the Advancement of Science also played an important role. Indirect U.S. Government encouragement of development of Latin American S&T capabilities and resources was exerted through active participation in multilateral organizations such as the Organization of American States, the Inter-American Development Bank, and the family of United Nations agencies such as the U.N. Development Program and the U.N. Education, Science and Cultural Organization. At the same time, U.S. universities and colleges of engineering, often through U.S.-sponsored scholarship programs and other tuition and subsistence subsidies, constituted an important source of training for Latin American scientists and engineers as well as technical expertise for cooperative projects. The involvement of many U.S. industrial corporations in joint ventures with Latin American companies represented another important dimension to intercontinental cooperation in science and technology.

The period of the 1960s and early 1970s was, in general, a time of intensive activity and growth in science and technology in Latin America. Large numbers of scientists and engineers were being trained in U.S. institutions, several cooperative linkages had developed between U.S. and Latin American research institutes and universities, AID was funding significant S&T projects in various countries, and the science and technology communities of many countries were becoming stronger and more confident. Institutional development as well as infrastructural improvements were occurring at a relatively healthy pace. Indeed, Latin America was seen as a leader in the developing world in formulating new approaches for the use of science and technology for development purposes, and the United States was an instrumental partner in that growth.

By the late 1970s, however, a subtle shift had begun to occur away from U.S. involvement in Latin America. Many Latin American countries had surpassed the level of GNP per capita required to participate in bilateral AID activities, thereby reducing U.S. involvement significantly. (Mexico became an AID graduate in 1970, Argentina in 1971, Brazil in 1973, Venezuela in 1974, Chile in 1977 and Colombia in 1980). During the same period, political unrest in the region intensified, causing many scientists to leave their home countries and making Latin America an unattractive area in which to invest U.S. programmatic funds. After 1982, a declining number of Latin American students were turning to the United States for undergraduate and graduate study, thereby further diminishing U.S. influence. Local resources for research and development began to shrink and support for key S&T institutions began to weaken; even the U.S. private sector involvement in Latin America appears to have become less substantial than in preceding decades.

The Changing Climate for International Cooperation

In more recent years, the S&T environment in Latin America has begun to stabilize with the reestablishment of democratic governments in many nations, the return of numerous scientists who left during the period of political turmoil, and the resumption of civilian control over many scientific and technical agencies. Domestic investment in S&T has increased and the research portfolios of the major countries have seen shifts toward emphasis on the development of technologically applicable areas of research, the profile of newly industrializing countries (NICs) seeking high-technology niches in the global economy. Although constrained by resource problems, Latin America has been able to attain a level of significant accomplishment and visibility in the international research community. Intra-regional forms of S&T cooperation are emerging, and European countries and the Japanese, recognizing the potential of Latin America as a market and trading partner, have been increasing their cooperative S&T efforts as part of their expanded involvement in the region. Training programs and contributions to scientific and technical resources are viewed as integral parts of other countries' long-term efforts to consolidate positions in Latin American high-technology markets of the future.

There are several specific examples of cooperation worth mentioning to give some perspective on what other countries are doing in S&T in the region. One of the major actors in S&T development in Latin America is the Canadian International Development Research Center (IDRC). The emphasis in IDRC's approach is to support research that is aimed at developing local S&T capabilities. The IDRC's efforts are particularly notable because over the years it has developed an image of sensitivity and responsiveness to local problems and is consequently viewed with considerable respect by the scientific and policy communities in Latin America. Through IDRC support, an entire generation of Latin American science and technology policy analysts has been trained, many of whom are in key positions in government, academia, and international organizations.

European governments are also increasingly involved in S&T cooperation in Latin America. West Germany, for example, has several cooperative agreements with the Economic Commission for Latin America and the Caribbean on a wide range of projects that include S&T. In addition, West Germany is reportedly offering more fellowships to Latin American students than it is able to fill. Germany together with France is cooperating with Argentina in the areas of renewable natural resources, endemic diseases, informatics and biotechnology. The Italian Government has been extremely active in supporting S&T projects in the region through multilateral organizations such as the United Nations Development Program. The Swedish International Foundation for Science has been providing fellowships for Latin American scientists, and the Swedish Agency for Research and Cooperation has also been active. Spain last year proposed a 'Marshall Plan' for Latin America that included S&T as one of its areas of emphasis. The European Commission is also expanding its efforts to cooperate with Latin American nations.

Interest in Latin America among Pacific Rim nations has been growing as well. Korea is planning to strengthen S&T cooperation with Latin America, as per a 1988 government announcement, and Japan already has S&T agreements with several Latin American countries, including Brazil, Mexico and Argentina.

The United States has not yet followed suit. The U.S. Government does continue to be involved in numerous science and technology related activities in Latin America through a variety of cooperative science programs and projects supported by the National Science Foundation and other federal R&D agencies, as well as development-oriented assistance programs of AID. Professional societies and private foundations, too, promote cooperation through activities such as joint symposia, short courses, and access to scientific publications. Nevertheless, available evidence points to a continued decline in the long tradition of science and technology interaction between the United States and Latin America. Few fellowships or other forms of financial assistance are any longer available for Latin American students wishing to come to the United States for higher education, and the number of such students has declined steadily from a high of 57,000 in 1982 to less than 44,000 in 1986. Although total dollar figures are not available, AID funding has diminished substantially and the number of NSF grants for activities involving Latin America flattened out in the mid-1980s.

FINDINGS AND RECOMMENDATIONS

If the United States wishes to reverse these trends, what are the most promising areas in which to invest in cooperation with Latin America? Let me turn now to our conclusions concerning the scientific fields and the types of activities that would be most productive in enhanced science and technology cooperation with Latin America.

Scientific Disciplines

In terms of prospective disciplines for mutually beneficial cooperation with Latin America, the importance of several fields stood out in the course of conducting our study: astronomy/astrophysics, biology, geosciences, physics/materials science, and engineering. For astronomy, biology and the geosciences, cooperation with Latin America is central to the advancement of the field through access to unique environments, features or specifically located instruments. The importance of southern hemisphere astronomy, Latin America capabilities in space science and remote sensing, environmental concerns, the biodiversity crisis, natural resource problems, and the emergence of earth systems science represent significant overlapping reasons for encouraging collaboration with Latin America in these fields. The other two priority fields identified--physics/materials science and engineering--represent areas that play an important role in technological development and economic growth. The Department of Energy, for example, is already involved in cooperative research on energy sources and systems, while activity in aeronautical engineering is of interest to NASA. Other technologically oriented areas in which activity in Latin America is significant include biotechnology, manufacturing control systems, and civil engineering of transportation systems and construction in earthquake zones. In each of the five priority fields, our study identified significant ongoing cooperation, major centers of activity, and evidence of scientific accomplishment in Latin America that represent specific opportunities to build on existing strengths through an expansion of cooperation.

Types of Cooperative Activity

Our study also generated a number of recommendations regarding modes and mechanisms for scientific cooperation with Latin America that are likely to be most useful over the next decade. Our recommendations fall into six main categories: human resources development, exchanges of researchers, laboratory equipment and instrumentation, communications links, libraries and journals, and outreach programs. The proposed legislation provides for activities within each of these categories. Perhaps it would be useful to the Subcommittee members for me to describe our perspectives on these aspects of the proposed legislation.

Human Resources Development

The draft Bill calls for the establishment of an "Inter-American Scientific Educational Development Fund," to provide graduate and post-doctoral fellowships for Latin Americans to study in the United States and U.S. citizens to study in Latin America, as well as collect and disseminate information relative to this and other opportunities for advanced study in the United States. Efforts to augment or enhance opportunities for education and training of Latin American scientists and engineers was found in our study to be one of the most significant areas for U.S. initiatives. While a number of specific areas and institutions were identified in which Latin American researchers have achieved international recognition and in which cooperation under present conditions could lead to mutually beneficial results, in most fields overall Latin American capabilities in terms of well-trained personnel are viewed as comparatively limited. There are often insufficient numbers of trained scientists and engineers to participate in collaborative projects in any meaningful way.

Human resource development represents an investment that can benefit both the United States and Latin America over the short- and the long-term. Efforts in this area will not only enhance S&T capabilities in Latin America, but contribute to greater understanding and goodwill between Latin America and the United States as well as facilitate cooperative research activities involving U.S. and Latin American scientists in the future.

Among the specific recommendations in this area that were made by our report, first and foremost was the need to establish an open, competitive, well-publicized fellowship program for Latin Americans to study at the doctoral and post-doctoral level at U.S. institutions. Moreover, it was found that Latin American governments often possess the funding to send their researchers abroad for advanced training, but lack current information on available programs and other opportunities. Wider dissemination of information regarding opportunities for study in the United States is, therefore, also of critical importance.

Exchange of Researchers

The proposed Bill provides for encouragement and funding of project development interchanges and joint projects between U.S. and Latin American scientists and engineers. Promoting the full involvement of Latin American scientists as equal partners in the exchange of researchers was also found in our study to be one of the most important activities for enhancing science and engineering cooperation with Latin American countries. Our report includes a number of concrete suggestions for new or expanded U.S. activities in this area, including the initiation of small program development workshops and the provision of travel funds for Latin American scientists to come to the United States and U.S. scientists to visit Latin America for the purpose of attending conferences, discussing collaborative projects, or conducting joint research. We found that existing NSF-administered bilateral agreements, in combination with the Science in Developing Countries Program, represent the type of flexibility that is required and should not only be continued but possibly expanded to encompass a greater variety of fields and institutions and to encourage the participation of larger numbers of scientists from Latin America and the United States.

Laboratory Equipment, Instrumentation and Maintenance

The proposed Bill calls for "Providing information to enable the routing of United States scientific equipment to Latin America, including information with respect to matching equipment with need, identifying technical maintenance requirements, and meeting customs regulations." Our study found that Latin American research institutions and facilities are often at a tremendous disadvantage due to outmoded, obsolete or often non-existent laboratory equipment and instrumentation. At the same time, it was noted that sophisticated laboratory or field equipment is of little value without the infrastructure of active research scientists who regularly make use of it, trained technicians and mechanics who can maintain it, and availability of spare parts that may be needed to repair it. Breakdowns of major equipment caused by malfunctioning of small parts that are often unavailable locally can sometimes keep a major Latin American facility out of operation for extended periods. Such problems are compounded and often insoluble when foreign exchange restrictions or cumbersome customs regulations also act as barriers.

Communication Links

There is a provision in the proposed Bill calling for the establishment of computer linkages between U.S. and Latin American scientists and engineers. The expansion and new development of communication links, using computer networks such as BITNET, SPAN or ARPANET, were found in our study to be potentially significant methods for enhancing collaboration among U.S. and Latin American scientists. Such networks can be useful in terms of communications regarding the planning of collaborative research, preparation of joint papers, exchange of information in the conduct of joint experiments, and exchange of data. In addition, computer networks may help alleviate some of the problems of isolation often experienced by Latin American scientists by providing ready information about the latest scientific developments and about which scientists and institutions are conducting given types of research; such information exchange might in turn encourage further scientific collaboration.

Libraries and Journals

The proposed Bill provides for the development of Latin American library resources and funding of publication costs. We found that Latin American institutions often suffer from serious limitations in access to major refereed journals, a problem that is heightened by the decreased U.S. buying power of Latin American currencies. In addition, Latin American researchers often find it difficult to publish in such journals for reasons that relate largely to prohibitive page charges. Our report made several recommendations for U.S. initiatives in this area, including assistance in subsidizing or waiving of page charges and making journal subscriptions available to Latin American research centers.

Outreach Programs

A recurring theme among the individual panel deliberations held in connection with our study was the necessity of improving methods of acquainting Latin American scientists with the various existing programs for cooperative research, educational activities, or use of major research facilities in the United States. There was a general concern that the limited publicity provided to such program opportunities had contributed to concentration of U.S. research partners in Latin American capital cities and among dominant scientists and institutions. Wider dissemination of materials regarding cooperative opportunities, especially to individual scientists rather than only to policy-making and research funding agencies, was recommended as an important means to expand cooperation. This need is touched upon in the proposed Bill in terms of collection and dissemination of information to Latin Americans on avenues for advanced study in the United States, but might usefully be expanded to include reference to research opportunities as well as advanced study.

CONCLUSION

Mr. Chairman, in conclusion I would like to state that the overall findings of the report we prepared for NSF, NASA and DOE last year in response to the full Committee's directives are clearly reflected in the provisions contained in the legislation currently under consideration by the Subcommittee. As I mentioned previously, a great many individuals, representing the U.S. scientific community, U.S. Government agencies, multilateral organizations and private sector organizations and associations were consulted in the preparation of that report and contributed to its overall findings. The outpouring of documents, information, and encouragement from Latin American government agencies and research institutions in response to requests for information during the conduct of that study is evidence of a positive attitude in the region toward a renewed U.S. interest in opportunities for S&T cooperation.

Science and technology are inextricably linked to the long-range U.S. concerns in Latin America, ranging from trade issues and the development of markets through matters dealing with the preservation of the environment and development of natural resources, to immigration patterns and Latin America's relationship to U.S. national security. The ways in which the Latin American nations prepare the next generation of technically trained professionals will have an impact on the future of U.S.-Latin American relations. In the absence of U.S.-sponsored opportunities, the important role that science and technology are being given in national development plans means that countries in the region will become increasingly involved with training and other S&T programs offered by Europe and Japan. A continuing decline in S&T ties between the United States and Latin America could represent a loss of influence with the technical sector of an industrializing region that could have significant ramifications extending far beyond the decade leading to the year 2000.

As pointed out in our study, a large number of U.S. Government agencies and private sector organizations and associations are involved or interested in cooperative activities with Latin America. What is currently lacking is the coordination of these efforts and the development of a coherent "profile" of the U.S. institutional system of relevance to cooperation with Latin America. Our report itself concluded that consideration should be given to the creation of a high-level panel or working group, consisting of representatives from U.S. government agencies, private foundations and industry, universities, professional associations, and the S&T policy community to follow through on the recommendations that were made, address issues such as the need for coordination of U.S. efforts in this area, and give direction to the development of initiatives for enhanced U.S.-Latin American cooperation in science and technology.

The proposed legislation provides for the establishment within the National Science Foundation of an Inter-American Scientific Cooperation Program, which will "cooperate with private and governmental funding bodies, both in Latin America and in the United States" and "provide a focal point in the United States Government for science and technology cooperation with Latin America." This concept clearly meets an important need identified in our study for a designated focal point in the U.S. Government to coordinate U.S. activities and to serve as a counterpart organization for multilateral and regional organizations in cooperative science activities involving Latin America.

Mr. Chairman, I commend this Subcommittee for its legislative initiative and appreciate the opportunity to appear before you today.

APPENDIX

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Mr. HALL. Thank you, Ms. Ailes.

I recognize Dr. Boright, Director of the International Division of the National Science Foundation, and you, too, can handle your presentation as you choose.

STATEMENT OF DR. JOHN BORIGHT, DIRECTOR, INTERNATIONAL DIVISION, NATIONAL SCIENCE FOUNDATION, WASHINGTON, DC

Dr. BORIGHT. Thank you, sir.

It is also a pleasure for me to appear here today. We very much—those of us who work in international science and technology cooperation—appreciate the interest of your committee in this question, and I am very glad to be here today.

In response to the request in your letter, I have prepared testimony which addresses the history and current status of NSF involvement in cooperation with Latin American countries, the current NSF activities that are related to the draft Inter-American Scientific Cooperation Act, the benefits to the United States and to Latin America of activities proposed in the draft bill, and the interests of U.S. scientists in working with Latin American scientists.

I will submit that statement for the record, and I will try to briefly summarize the points in it for you.

Mr. HALL. All right, sir.

Dr. BORIGHT. The involvement of the National Science Foundation with Latin America dates back to about 1959, when there was a major international effort, the International Geophysical Year. That event was the forerunner of another major effort that I will refer to in a few minutes.

In the 1960s, NSF was involved with several fairly substantial AID-supported educational programs.

It was only in 1971 that NSF began to develop cooperative science activities with Latin American countries, participating as Executive Secretary in a Science and Technology Interagency Agreement with Brazil. That agreement was followed by similar agreements with Argentina and Mexico and, finally, in 1983 with Venezuela. Those are the four government-to-government level agreements that are now in effect.

Under these agreements—I also should add not constrained by the existence or the absence of those agreements—NSF does fund short-term planning visits and the U.S. side of cooperative projects and workshops.

The agreements and similar activities with the other countries of Latin America grew rather rapidly in the 1970s, followed by a mixture of some growth and some decline in the late '70s and early 1980s as countries in the region faced economic uncertainties and very high inflation.

In 1980, we added an important new flexibility to the National Science Foundation programs by adopting the Science in Developing Countries guidelines. Under this program, which recognizes the different needs and constraints of scientific cooperation with less developed countries, more than half of the awards are with Latin America, although it is a worldwide program.

This program, Science in Developing Countries, combines both NSF's usual emphasis on mutual benefits, but also a component that gives preference to projects relevant to development priorities of the participating countries.

As you have just heard and as you outlined yourself, last year we did commission a study, organized and conducted by SRI, of New Directions for U.S.-Latin American Cooperation, and you now have that study and the presentation on it.

I should note that the opinions and recommendations in the SRI report are those of the authors and contributors, and it is not an Executive Branch report, as you know.

The primary objectives of NSF's activities in Latin America or in supporting cooperation with Latin American counterparts are to improve the access for U.S. scientists to research opportunities and to facilitate mutually beneficial interactions with Latin American scientists.

We accomplish these objectives through a variety of programs. The Division of International Programs offers supplemental support to American scientists and engineers to extend or enhance their ongoing research by means of collaborative arrangements with colleagues in Latin America.

Last year we spent about $1.2 million in such support. I should say, to put that in perspective, that is approximately 10 percent of the resources that the division had for all of our activities worldwide.

In addition, through the many disciplinary programs of the National Science Foundation, cooperation with Latin American counterparts is encouraged or facilitated or funded in a variety of ways.

There are several hundred projects each year which involve field observations or experiments on a wide variety of natural phenomenon in or around the countries of Latin America. Virtually all of these project entailing field work also involve substantial cooperation with Latin American counterpart scientists.

In addition, there are many awards in NSF which support attendance at meetings, conferences, and symposia, which may also take place in Latin America or which may involve Latin American participants.

NSF also funds American participation in large multi-national research programs. Often these are studies on the functioning of large-scale earth systems and often are housed within our Geosciences Directorate.

Finally, NSF supports overseas facilities and operations in Latin America in those cases where sustained access and logistical support is scientifically warranted. These operations generally offer access to host country scientists and preferential treatment for other Latin American visitors. An example is the Inter-American Observatory in Chile.

Total expenditures last year for all activities which had some Latin American cooperative component was something over $50 million.

In anticipation of a question, I might interject that our bookkeeping is not sufficiently accurate to be able to tell you exactly what fraction of that $50 million was actually directly associated with cooperation with Latin American counterparts, but it would not be the majority. It would be a modest fraction of that.

As pointed out in your draft bill, international science and engineering relationships are increasingly important, not only with the most scientifically advanced countries but also with developing countries because of the importance of human resources and unique environments that we all have. In a shrinking world of rapid communication and global issues, science is ever becoming more an international activity.

Biology and geoscience are noted in the SRI studies as important fields for cooperation with Latin America. In 1989, NSF started an initiative on global change as part of the U.S. Global Change Research Program. A separate but closely related initiative in biodiversity in 1990 is going to focus on understanding the extent and environmental implications of the loss of species and habitats. Initiatives such as this will lead to greater interaction and joint activities with scientists in Latin America.

In the International Programs Division, the Cooperative Research and the Science in Developing Countries Programs will take advantage of the leverage of these broader national initiatives.

While it is true that the present financial conditions of our bilateral partners in Latin America and our own budget limitations prevent joint funding of as many projects as we would like, current plans are to support a greater number of program development workshops to focus on research opportunities in the different countries of the region and to continue the increase of the number and the flexibility of our Science in Developing Countries awards.

Our approach, however, is still going to focus on scientific merit and mutual benefit, themes that are just as important to our counterparts in Latin America as they are to us.

Let me skip on to the question of human resources, which I think is a very important one, as pointed out both by your bill and by the SRI study.

The SRI report does point to a lack of fellowship opportunities in the United States for Latin Americans. As you know, NSF is keenly aware of the insufficient fellowship opportunities in many categories, but of course including our own citizens, minorities and women in particular, and we have been taking steps in the budget to substantially increase those opportunities.

We agree on the desirability, on scientific and on broader grounds, of extending such fellowship support to others, but we realize that in the current budget climate, support for this effort could come at the expense of other domestic or international efforts now rated at an even higher priority.

As you are aware, science and engineering education is the most rapidly growing component of NSF programs, and we will be looking for mutually beneficial opportunities for cooperation with Latin American counterparts in this field of education.

We also note that the committee emphasized utilization of existing Centers of Research Excellence in Latin America. At NSF we are addressing this issue through our new Information and Analysis Section. This section has initiated efforts to report on the status of Latin America and related issues, first for the benefit of program managers within the National Science Foundation and then to an increasing degree to make that information available to the broad American science and engineering community.

The bill also expressed interest in promoting computer linkages between U.S. and Latin American entities. Our efforts in that direction include a jointly sponsored seminar with the OAS, which will take place in Costa Rica in June.

The organization of a pilot network of Latin America Networks, similar to the role that NSFNET plays in our national situation, is on the agenda of that meeting. Support for that network is to be sought from the Inter-American Development Bank and from other sources.

With regard to the benefits to the United States and Latin America of activities proposed in the draft bill, revitalizing and continued expansion of our cooperative programs as currently planned should lead to increased mutual benefits access to unusual research localities and facilities and to talented people in Latin America.

The committee's bill addresses the human resource issue on an Inter-American level. The SRI report considered the education and training of American scientists and engineers one of the most significant areas for U.S. initiatives.

The training of the next generation of Latin American scientists and engineers could indeed lead to greater access not only for the U.S. researchers, but also for trade and business sectors as it did in the '60s and '70s. We hope that the increased flexibility and the increased funding that we intend in our science and developing country programs will contribute to that goal.

With regard, finally, to the interest of U.S. scientists in working with Latin American scientists, I would simply summarize by saying that the interest is encouragingly broad, and it relates not exclusively to the global and biosystem areas that I have mentioned, but also to fields such as mathematics, materials science, astronomy, and a broad range of engineering fields. We do believe there is a healthy interest in the American scientific community.

We also recognize that we should not underestimate the level of interest from private industry and foundations, which are often larger than our own efforts. We are exploring ways in which such investments can best be used by researchers in academia and industry and in other settings.

I would like to close, Mr. Chairman, by again saying that I very much appreciate your interest in U.S.-Latin American cooperation in science and technology. In our cooperative programs with the countries of the region we try to ensure the quality of our S&T programs and to rely on mutual benefit as the cornerstone of our programs.

The Administration does not support the adoption of this legislation because it duplicates existing programs and constrains the Foundation's flexibility to respond to the evolving nature of these and other priority research needs, especially in the current fiscal environment. Although we do not support enactment of this legislation, we are committed to working closely with the committee to ensure that our ongoing programs accomplish our common goals in this important region of the world.

Thank you very much.

[The complete prepared statement of Dr. Boright follows.]

TESTIMONY

DR. JOHN BORIGHT

NATIONAL SCIENCE FOUNDATION

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION

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Introduction

Mr. Chairman, it is a pleasure to have the opportunity to discuss with you cooperation with Latin America in science and technology and to describe NSF activities in this important area. Some of the comments and suggestions I am making here today are contained in the SRI report on New Directions for U.S.-Latin American Cooperation in Science and Technology that we submitted to you last June. I wish to also point out that Dr. John Moore, Deputy Director of NSF testified to this committee on this topic in July 1987.

I am the Director of the International Division (INT), located in the Scientific, Technological and International Affairs Directorate (STIA). INT provides support for international science activities, including cooperative research and workshops, but also has the main responsibility for keeping track of developments in international science for the Foundation. Consequently, activities in science and technology involving Latin America is an important area of consideration for INT.

History

The Foundation's first involvement with Latin America dates back to 1959 with the organization and support of the International Geophysical Year. At the time several activities relating to that special emphasis were held in the region. A more formal involvement came about when the Foundation opened a Latin America Office in Rio de Janeiro, Brazil under the auspices of AID. This office was part of a U.S. Regional Science Office in Latin America, which included other U.S. Government agencies. The function of the NSF office at that time was primarily to gather information on scientific activities in Latin America. NSF withdrew from the Rio office in 1964 because budgetary constraints precluded the possibility of developing and funding active cooperative science programs in Latin America.

However, during the next few years NSF became actively involved in Science Education Assistance Projects in Latin America, which were funded through AID. There were two separate projects, one dealing with the improvement of science and mathematics teaching at the upper secondary and college level in the whole Latin American region; the other to upgrade the teaching of science and mathematics in the national universities of Central America and Panama. To coordinate the second project NSF maintained a small staff in San Jose, Costa Rica until 1968.

Starting in 1971, NSF began to develop cooperative science activities with Latin American countries, participating as executive agency in a Science and Technology Interagency Agreement signed with Brazil in that year, followed a year later by similar arrangements with Argentina and Mexico. In 1983, Venezuela joined the list of countries with bilateral agreements and that group remains the same today.

Under these agreements, the Foundation, through INT, funds short-term planning visits, and the U.S. side of cooperative projects and workshops. The agreements led to rapid growth in cooperative activities in the early 70's followed by haphazard growth and declines in the late 70's and early 80's, as the countries in the region faced economic uncertainties and raging inflation.

In 1980, the International Division initiated the Science in Developing Countries Program (SDC). This program was established in recognition of the different needs and constraints of scientific cooperation with the less developed countries. Though the program is worldwide, more than-half of its awards involve scientific cooperation with Latin American and Caribbean nations. SDC combines NSF's usual emphases on mutual benefits with an assistance component that gives preference to projects relevant to priorities of the participating countries and that strengthen their capabilities to perform research and train scientists and engineers.

Last year, at the request of this Committee, NSF chose SRI to conduct an independent study of new directions for U.S.-Latin American cooperation in science and technology. The study concluded that a new climate has emerged for cooperative initiatives with Latin America, one in which S&T is seen as an integral part of the region's efforts to solve its international debt problems, to achieve economic growth and a place in the global economy, and to deal with environmental concerns and the conservation of natural resources.

I must note that the opinions and recommendations in the SRI report are those of SRI and should not be construed as reflecting the views of the Administration. However, last month we held a follow-up meeting of different agency, foundation, and academic representatives to discuss the state of Latin American cooperation and initiatives. We expect to have a report on that meeting out shortly.

Objectives

The primary objectives of NSF's activities directed at Latin America are to improve access for U.S. scientists to research opportunities and to facilitate mutually beneficial interactions with Latin American scientists. These objectives are accomplished through several approaches:

1. Through INT, we offer supplemental support to U.S. scientists and engineers to extend or enhance their ongoing research by means of

collaborative arrangements with colleagues in Latin America. Last year we spent approximately $1.2M in such support.

2. Through our many disciplinary programs, we facilitate and encourage cooperation in various ways:

> Several hundred projects are supported each year involving field observations and experiments on a wide variety of environmental conditions and natural phenomena in or near the nations of Latin America and the Caribbean. Others involve attendance at meetings, conferences, symposia, etc. held in these countries and considered significant for the U.S. researcher's work. These projects are selected primarily because of their scientific merit. Nearly all of the projects entailing field work involve substantive cooperation with scientists in these countries and others involve casual contacts and sharing of information with local scientists.
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> NSF also funds U.S. participation in large multinational research programs, some of which are coordinated through the International Council for Scientific Unions (ICSU) or the United Nations organizations. Being mostly studies of the functioning of large scale environmental systems, these projects are usually lodged in our Geosciences Directorate and are intrinsically cooperative in nature due to the large manpower and logistic needs and consequent costs. While the geographic focus of some of these projects is in Latin America or the Caribbean, the cooperative arrangements often involve other nations as well.
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> Finally, NSF supports several overseas facilities and operations in Latin America, where sustained access and logistic support is scientifically warranted. These operations are fully cleared with local authorities and they generally offer access to host country scientists and preferential treatment for other Latin American visitors. Examples include the Cerro Tololo Interamerican Observatory in Chile, the Organization for Tropical Studies in Costa Rica (OTS), and the Jicamarca Observatory in Peru.
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> Total expenditures last year for these NSF activities with some Latin-America connection came to nearly $52.3M.

NSF activities for 1990 and the Inter-American Scientific Cooperation Act of 1989.

In the past few years the National Science Foundation has played a significant role in raising the awareness of the important part that science and technology play in our national and global affairs.

Due to Congress' and the Administration's increased focus on science and engineering and the role played by NSF in the overall U.S. scientific enterprise, the Foundation is now a more important participant in federal science and technology efforts. Our programs provide broad support for research and science and engineering education, and regularly add components related to new areas of particular promise.

International relationships are increasingly important, not only with the most scientifically advanced but also with the developing countries because of the importance of human resources and unique environments that we all have. In a shrinking world of instant communication and electronic access, science is ever more an international activity.

For 1989 NSF has proposed a new initiative on Global Change as part of the U.S. Global Change Research Program, that seeks to understand how the earth functions as an interconnected system. A separate, but closely related initiative in Biodiversity, focuses on understanding the extent and environmental implications of the loss of species and habitats.

Both of these initiatives will lead to greater interaction and joint activities with scientists in the Latin-American region. In INT, the cooperative research and SDC programs will take advantage of the leverage afforded by these two initiatives. While it is true that the present financial conditions of our bilateral partners in Latin America preclude their joint funding of as many projects as we would like, current plans are to support a greater number of program development workshops, focus on research opportunities in the different countries of the region and continue the increase in the number of our SDC awards that provide some flexibility to allow for the payment of some of the costs of the foreign scientists. Our approach, however, will still focus on scientific merit and mutual benefits, themes that ring true with our counterparts in those countries.

Our staff in INT is keeping in close contact with representatives from the professional societies, in an attempt to identify unusual research and educational experiences not normally covered under the standard cooperative programs. I already mentioned our convening last month of a working group of agency, foundations, and academic representatives to monitor Latin American activities in S&T and explore the joint sharing of resources.

NSF has placed human resources development at the top of its list of priorities. I note that the proposed bill calls for the establishment of an Inter-American Scientific Educational Fund to provide funding for: graduate and post-doctoral fellowships for Latin Americans in the U.S.; the collection and dissemination of information to Latin Americans on procedures for advanced study in science and technology in the U.S.; and U.S. assistance for the development of courses, seminars, and curriculum in science and technology.

This is an important area: the SRI report points to the lack of fellowship opportunities in the U.S. for Latin Americans. As you know, NSF is keenly aware of the lack of fellowship opportunities for many of our own U.S. citizens, minorities and women included, and has taken steps in its budget submission to the Congress to address that issue. We see the desirability on scientific and broader grounds of extending such fellowship support to others but realize that in the current narrowly constrained budgetary environment, support for this effort could come at the expense of other domestic or international efforts now rated at even higher priority. This would be counterproductive.

I also note that the Committee has put a special emphasis on the sharing of information with our Latin-America counterparts as it relates to library resources, and on the utilization of existing centers of research excellence in Latin America.

At NSF we are addressing this latter issue through our new Information and Analysis section, within INT. The section has initiated efforts to report on the status of Latin American science and related issues. This information has two avenues of dissemination. First, NSF has an on-line electronic mail system, which currently is available only internally but eventually will be accessible to the scientific community at large. Second, the Section produces a publication called International S&T Insight, which reports on science policy developments throughout the world. Insight will be published several times a year. It is also distributed internally at NSF with a broader distribution anticipated. The objective of this reporting is to inform NSF staff and the scientific community at large about possible emerging scientific strengths in Latin America and other regions so that U.S. scientists and policy-makers may form the basis for new cooperative initiatives.

The Committee has expressed its interest in promoting computer linkages between the U.S. and Latin America. I want to report that our efforts in that direction are leading towards a jointly supported NSF/OAS seminar of networking experts from the region, to be convened in Costa Rica in June of this year. The organization of a pilot network of Latin America networks, similar to the role NSFNET plays at the national level is on the agenda. Support for that network is to be sought from the Interamerican Development Bank and other sources.

Benefits to U.S. and Latin America of proposed bill.

The movement by many Latin American nations toward democratization of the late 70's encouraged the return of emigre scientists and engineers. At the same time, and despite financial hardships, domestic investment in S&T increased in relative terms. Increasingly, science and technology is viewed as contributing solutions to developmental problems. Intra-regional forms of S&T cooperation are emerging--such as the recently initiated Argentina-Brazil trade agreement including S&T cooperation--that bode well for progress in science and technology.

The European countries and the Japanese, recognizing the potential of the region as a market and trading partners, are increasing their cooperative investments in S&T and in human resources. While many of the countries in the region look to us as the leaders in this area, it is important to recognize that there is increased competition and our initiatives should be considered in that context. Revitalizing our cooperative programs as currently planned should lead to increased access to unusual research localities and facilities plus talented people.

The Committee's bill addresses the human resource issue on an Inter-American level. The SRI report considered the education and training of Latin American scientists and engineers one of the most significant areas for U.S. initiatives. "...efforts in this area will not only enhance S&T

capabilities in Latin America, but contribute to greater understanding and goodwill between Latin America and the U.S. as well as facilitate cooperative research activities involving U.S. and Latin American scientists in the future."

Not surprisingly, the majority of the panels of experts assembled for the SRI report considered the human resource issue an essential priority for U.S. involvement. The training of the next generation of Latin American scientists and engineers could lead to greater access not only for U.S. researchers, but also for our trade and business sectors as it did in the 60's and 70's.

Additionally, I see a tremendous benefit to be derived from the networking efforts that we have initiated and which this bill supports. The possibility of interactively linking researchers from Latin America to U.S. researchers--which already exists with Mexico and Chile--promises to change and expand our own definition of collaboration. We may see in the next few years the breakdown of national barriers to S&T collaboration and the removal of the isolation (geographical and otherwise) often felt by researchers in developing countries.

Interest of U.S. scientists in working with Latin American scientists

Our activities with Latin America point to a strong interest by U.S. scientists in collaborating with Latin American scientists. This interest is not restricted to scientists engaged in field research in exotic locales in the area, but is also apparent among scientists in other disciplines such as mathematics, materials science, astronomy, and a broad range of engineering fields.

As a point of reference, preparatory to the SRI report, SRI sent a questionnaire to a representative sample of over 600 U.S. scientists and engineers, inquiring about various facets of collaboration with Latin American scientists and engineers. The response rate was quite high for the sample and the initiatives suggested were a good indicator of the level of interest in the scientific community.

A measure of the degree of interest of U.S. scientists in working with Latin American scientists and engineers, can be obtained from the activities of the professional societies. The AAAS, the APS, the American Society for Microbiology have all existing or are planning initiatives involving the region. Our own Engineering Directorate is organizing a series of workshops in conjunction with the OAS in the areas of biotechnology, ocean resources, and materials engineering that are responsive to the strong interests of the community.

One should not underestimate the level of interest from private industry and foundations, which often dwarf our own investment in these programs. For example, several U.S. computer manufacturers have invested hundreds of millions of dollars in developing networks and educational software for Latin America. We are exploring ways in which such investments can be best used by researchers in academia, in industry, and in other settings.

Further comments on the Inter American Scientific Cooperation Act of 1989

Mr. Chairman I commend you for your interest in promoting U.S.-Latin America cooperation in science and technology. Through our cooperative programs with the countries in the region, we have taken the view that ensuring the quality of our S&T programs and relying on mutual benefits as a corner stone of our programs results in benefits for all.

The Administration does not support this legislation because it duplicates ongoing programs mentioned previously and significantly restricts the Foundation's flexibility to respond to the evolving nature of these and other priority research needs, especially in the current constrained fiscal environment. Although we do not support the enactment of this legislation, we are committed to working closely with the committee to ensure that our on-going programs accomplish our common goals in this important region of the world.

The Office of Management and Budget has advised that there is no objection to the submission of this testimony from the standpoint of the Administration's program.

Mr. **Hall**. Mr. Boright, thank you.

I might note the addition of two of the mainstays of this committee, George Brown from California and Bob Walker from Pennsylvania. Really, Mr. Packard and I just kind of get it to going, and these two hard-line pros come and wind it up.

We at this time, George, would be glad to hear anything from you if you want.

Mr. **Brown**. Mr. Chairman, why don't you go ahead, since you got here first?

Mr. **Hall**. I already said everything they wrote out for me to say. [Laughter.]

I would be glad to recognize you for an opening statement at this late date, I guess is what I am saying.

Mr. **Brown**. Thank you very much. I don't have an opening statement, but I would like to offer some comments.

In listening to what I have heard and reading over the testimony, I gather that there is a substantial difference of opinion between the Foundation and SRI with regard to the actual need for any enhancement of programs there.

Is that a correct interpretation?

Ms. **Ailes**. Mr. Brown, may I answer that perhaps first?

Mr. **Brown**. Sure.

Ms. **Ailes**. I don't believe that there is a substantial difference of opinion. Our report was completed a year ago, just about a year ago, in June 1988, and I think that at that time, with the exception of the areas of exchanges of researchers, the National Science Foundation was not undertaking activities in the other five sorts of areas that we thought were important.

I think what I was hearing Dr. Boright say is that they have in the meantime begun to initiate some of these programs in those kinds of areas, and I think that he also would agree that these are important things to increase in the future.

Mr. **Brown**. All right.

Dr. **Boright**. I would also not want to exaggerate any differences, the few that you would pick up. I think that everyone here—opening comments by the Chairman and others, by Ms. Ailes and by myself—all recognize the importance of cooperation with Latin American scientists and the potential benefits, both scientifically and in the broader national interest. I don't think there is any question about that.

Of course I am here representing the Administration, and this bill, as written, has financial implications. I tried to give you a framework by saying that we are now putting about $1.2 million into Latin American cooperation. In terms of actual cooperative activities, that funds most of the high quality proposals that we have. So a change from there to the levels contemplated in the bill would be focused, I think as accurately discussed here, on fellowships and training and not probably mainly on cooperative science.

On the question of fellowships, it certainly is desirable. There simply is not room within the existing NSF budget, and with the painful internal choices we have to make, for that level of fellowship support for people from other countries.

Mr. **Brown**. Well, I think the bill is certainly broader than merely fellowship support. I suspect that it is aimed at correcting a number of the deficiencies which the Chairman and others of this committee perceived in the contacts that we have had with Latin America over the last few years.

I don't really see your statement as being as constructive of responses as I would like to see to this situation, but I don't want to be overly critical. I tend to look at this from the standpoint of not only how we can enhance scientific cooperation, but what this may mean in the broader social and political sense of our relationships with these countries.

There is a very real possibility that the dynamics of global politics are going to change drastically in the next few years, and I don't want to make this a forum to discuss that, but if we lose the enemy that we have had for the last 75 years and then suddenly find that we have created some less than friendly people in our own backyard as a result of a debt problem and other things of that sort, we really haven't done as well as we should be doing, and I am sure that many of us perceive this as an opportunity to build the linkages that will not only contribute to science but will contribute to our global strength over the next generation and that this is a very important consideration.

I don't want to get into that particularly, but my perception of what you are saying is that you have a good program over there, you are revitalizing it, but you don't really need any advice from Congress as to how to do it, and although your budget is doubling in the next five years you really are stuck for an extra few million dollars to help out on this.

Is this the thrust of what I am hearing?

Dr. BORIGHT. Well, with regard to your first point about not needing any advice from Congress, in fact, we did, at your instruction, fund the SRI study. That was a fairly substantial commitment of effort, by many people within the government. In fact, I think that was quite a healthy thing, and it does constitute a very useful compilation of advice.

As Ms. Ailes pointed out, some of the elements suggested in that study in fact are being reflected in—perhaps modestly—our programs.

So I don't think that, indeed, we would take the position that we don't need and couldn't use advice. I think, rather, the record of NSF is quite the opposite. We are probably the most heavily advised organization with which I have ever been acquainted in the sense of a tremendous array of external advisory committees, and so on.

So I could just say I believe that we are quite open to ideas of this sort.

Mr. BROWN. Well, let me just indicate a part of the basis for my making a statement like that, and I am not really trying to be all that reasonable. I am trying to needle you a little bit.

I have watched our efforts to aid in science programs in Latin America for 20 years. They go up and down. The Administration will sign a nice new science and technology cooperation agreement with Mexico or some other country. The President will do this, not the Congress, and announce big plans, and three years later it is forgotten.

I have talked to innumerable representatives of American academic institutions who say they would love to cooperate more, but they just can't get any money out of NSF, or whoever, even for travel expenses, to go down and talk to these people.

You used the term that you are going to revitalize existing programs, and that is very noble. I hope that this actually will occur, but that hasn't been the record to date. The programs have been going downhill. They tend to fluctuate in a way which is not contributing to our good relationships or the improvement of science either. Most people are disillusioned, and it is the view, I think, of those on this committee who have initiated this legislation that it deserves better than that. It deserves, we will say, a line item and an evidence of Congressional and Executive commitment to a very important program.

I know that you won't make the decision as to whether or not we go ahead with something like this, but I want the record to reflect that that is the view of one old Congressman who has watched these things for a long time.

Mr. HALL. Dr. Boright, you are the Administration here today. So you are the only one we have to hammer on. [Laughter.]

And I really hate to lose you, you know, after this committee. I wonder, would it be—you know, we have a distinguished group on the next committee, also, and I wonder if it would be possible maybe for you to stand by and join in, just a real love-in, with them on this subject.

Are you on a tight schedule this afternoon?

Dr. BORIGHT. No, sir, I intend to stay.

Mr. HALL. And Ms. Ailes, too, of course, if you can.

Dr. BORIGHT. I recognize, indeed, you have a very impressive group.

Mr. HALL. We have a lot of problems here, and this bill cries out some problems, even for me, and I am on the bill as a cosponsor. But there are some questions that I would like to have answered, and I, too, dream of a South America that cares for this country and loves this country and that we reciprocate and have the days like we had them when we had probably the strongest position of economic prosperity and geopolitical strength in the history of this country in the late '40s and early '50s, and we had good relations there, and it seemed like the money we spent there came back to us, and vice versa.

I guess that is the Utopian goal that we are looking for. I think most of the other people on this committee I have scanned—or had their testimony scanned, and most of them seem inclined toward not direct support of the Inter-American Scientific Cooperation Act of 1989, but that there is a need there for something further to be done, and I think we might really get something out of a discussion after we hear these other four panelists testify.

But right now I would recognize Mr. Walker, who is the Ranking Member on the entire Science, Space and Technology Subcommittee, an authority on just about everything. We recognize him for an opening statement or for whatever he wants to spend his two minutes.

Mr. WALKER. That covers the waterfront. I thank the gentleman.

Let me just ask a couple of questions. I don't have an opening statement either, but let me ask a couple of questions.

The material that is in the bill, Dr. Boright, is there anything in here that you regard as being different from what you are now doing?

Dr. BORIGHT. Well, the last paragraph, which in essence is the financial implications of it, are clearly different.

Mr. WALKER. Okay, that is different, but in the substance of the bill?

Dr. BORIGHT. But that aside, really, no. There is no component of the effort, with the exception of the one that I focused on the most that discussed the question of fellowships for people from developing countries. Except for the question of priority for that, there is no real difference.

Mr. WALKER. Okay. So all that is in the bill you are already doing or think you are doing at the present time?

Dr. BORIGHT. I would never say we are doing enough on any of those things.

Mr. WALKER. No, no, no, I didn't say that. But from your perspective, you are doing all of the things that this bill covers?

Dr. BORIGHT. We are doing the things that we can afford and that seem to be the highest priority in those areas, yes.

Mr. WALKER. That is a different answer than the question I am asking. I am asking you—you know, obviously you have spent some time looking through this bill—are the things that are covered by this bill now being done by NSF?

Dr. BORIGHT. In the general categories, yes. I am not trying to be evasive. It is just that I think the bill foresees, given the budget levels that it portrays, a higher level of activity than we are doing, and I don't want to tell you that we are doing everything that is in there, yes.

Mr. WALKER. Well, that is another question. I mean, I am getting to the question of relative priorities here, but from your perspective you don't have any problem with the direction that this bill is going?

Dr. BORIGHT. No problem.

Mr. WALKER. And you think that at some level you are doing most of what is in the bill?

Dr. BORIGHT. Yes.

Mr. WALKER. So the real argument with regard to the bill is an argument about Section 5, where Congress puts a specific sum of money beside the things that are being done, which is different from the sum of money that you are now spending?

Dr. BORIGHT. That is basically true.

Mr. WALKER. Okay.

Dr. BORIGHT. There are some parts of the bill that we haven't talked about, the reporting requirement for example. I think that is a relatively minor thing. I think, as you summarize, it is basically right.

Mr. WALKER. Okay, and as I understand it, you are now spending about $1.2 million in these relative areas?

Dr. BORIGHT. Yes, which we hope will increase.

Mr. WALKER. Which you think will increase?

Dr. BORIGHT. Yes.

Mr. **Walker**. How much do you think it will increase to?

Dr. **Boright**. I hope that if NSF's budget does indeed double, as endorsed by the last two Presidents, that our budget will go at about the same increasing rate; that is, hopefully this will double over a period of a few years, several years.

Mr. **Walker**. Well, you are spending $1.2 million now. When you say a few years, you are going to $2.4 million when?

Dr. **Boright**. We haven't adopted an internal plan that has that level of detail, but if it tracks the overall NSF budget, it would be in a four or five-year time frame.

Mr. **Walker**. Four or five-year time frame?

Dr. **Boright**. Yes.

Mr. **Walker**. And this bill contemplates going to $10 million by 1991, and what you are saying is, that would diminish resources from other places in NSF in order to meet this priority, is the point that you are making?

Dr. **Boright**. Yes.

Mr. **Walker**. And that the diminishing of resources could come out of university research, it could come out of various things.

Would it come out of other international areas? I mean, if we made this kind of demand, would that in fact cause you to have to readjust the monies in your division and take money away from international cooperation with Asia in order to——

Dr. **Boright**. Certainly, to some degree.

Mr. **Walker**. How much money do you have overall in your budget?

Dr. **Boright**. We have about $13 million, approximately. That is why I said this was about 10 percent. We have about $13 million of appropriated funds. We do have access to some other resources that increase that by about 50 percent.

Mr. **Walker**. But this is all appropriated funds that are covered by the bill.

Dr. **Boright**. That is right.

Mr. **Walker**. So by the year 1991 this bill would have us usurping $10 million of the $13 million available to you?

Dr. **Boright**. I am afraid that is the way it looks.

Mr. **Walker**. Unless we found other sources for money to substantially increase monies into the International Division.

Now, suppose we—instead of earmarking monies in this manner, what if what we did was required you to report on your activities and did not earmark specific funding. Would that cause you to change your program in any way?

Dr. **Boright**. Well, I hope that we have a reasonably good record of reporting in any case at an informal, perhaps more often at the staff level than to members, but we will do that in any case.

Mr. **Walker**. Well, you made mention, though, that Section 4 is different from what is now the case.

Dr. **Boright**. It is more formalized, yes.

Mr. **Walker**. And you would not have a problem with that formalized procedure?

Dr. **Boright**. No problem in principle.

Mr. **Walker**. Thank you, Mr. Chairman.

Mr. **Hall**. Okay, now we can either start questioning these two witnesses or hold them together. What is the Ranking Member's wishes on that? Want to go ahead and hear the other two and then begin our questions—the other four? Does that suit you?

All right. You are not nearly out of the woods. If you will stay with us a little bit, we will introduce our next distinguished panel.

All right, we are certainly honored to have with us today several distinguished individuals from the private sector to speak in support of the bill, I understand, or to address the bill and its objectives.

We have the Honorable Harry Barnes, who served as U.S. Ambassador to Chile from 1985 to 1988 and was very instrumental in reviving S&T relations between the United States and Chile among his other many accomplishments.

We have Dr. Lewis Tyler, who is Executive Director of the Latin American Scholarship Program of American Universities, a nonprofit organization concerned with institutional development in Latin America.

Dr. Moselio Schaechter is a Professor at Tufts University Medical School and a past President of the American Society for Microbiology.

Dr. Leon Lederman. We are certainly honored to have Dr. Lederman here, a co-winner of the 1988 Nobel Prize for physics, and he is the Director of Fermilab in Batavia, Illinois, and for several years Dr. Lederman has actively promoted greater S&T cooperation with Latin America and I am told is one of the real leaders, one of the real giants in connection with the supercollider thrust and move in this country.

We are honored to have all of you here. It is really great of men and women like this panel here to come and to give your time. It may be disconcerting to you sometimes not to see more members than are here, but, believe me, they have five other subcommittees, each of them, and your testimony is being taken down. It will be spoon-fed to every other member of this committee, and the members of the big committee also will get copies.

So honored to have you. We would lead off, I guess, with Mr. Ambassador Harry Barnes, if you want to lead off, and you might just review your testimony or you can read from a prepared script, any way you want to do it.

We recognize you, Mr. Ambassador.

STATEMENT OF THE HONORABLE HARRY G. BARNES, JR., FORMER AMBASSADOR TO CHILE, PEACHAM, VERMONT

Dr. Barnes. Thank you, Mr. Chairman. I think I will limit myself to just a couple comments, since I have covered much of what I need to say in the written testimony.

Thank you for including me in the private sector. I am still getting used to it. It has only been a couple of months since I left Chile.

But I will speak today against the background of those several years in Chile. That doesn't, however, make me a Latin American expert, at least as far as the whole continent is concerned.

But I did have the pleasure of welcoming several of the members of this subcommittee, Mr. Brown and Mr. Packard, when they were in Chile last year at the time of the 25th anniversary celebrations of the Cerro Tololo International Observatory.

I would make just three points, one from my prepared statement and two that are perhaps inferred from it.

The first point has to do with a conviction, based on the time in Chile, that the legislation you are proposing needs to stress in every way that it can the importance of cooperation being a mutually beneficial cooperation if the cooperation is to be effective and is to have a long-term effect, and it has got to be seen by those who are involved in Latin America as something which they have an interest, in which they have a stake, and in which they have participation.

The legislation goes somewhat in that direction, but I have suggested several ways where that might be carried out even more fully. I think that is what you are attempting to do, as I understand it, but I think it could be expressed more clearly, and I think it is important in terms of the audience and of eventual participation of Latin Americans as well.

Secondly, there is a point in the legislation where reference is made to cooperation among various parts of our own society, government and nongovernment. I think it is useful to bear in mind that in addition to governmental resources there are others in our own society who can contribute a good deal.

Mr. Tyler and I, for example, were involved in a project, which he might be able to touch in some more detail at some point, involving the private sector of Chile and the American Chamber of Commerce in a scholarship program, Dr. Rowe from the American Association for the Advancement of Science and I also have been involved in a project in terms of reviving cooperation between Chilean and American scientists, efforts which show what can be done between government, or among government, private sector, university, and research institutions as well.

Thirdly, on the question of resources, I am not sure what the right sum is. One question I would simply leave with you is whether in carving out an area that I agree is extremely important in terms of projecting some continuity in the approach from the United States toward Latin America, which as Congressman Brown referred, that essentially carved out an awful lot, and I am not sure whether given that territory you have staked out the resources are commensurate. I simply leave that as a question to you.

Thank you, Mr. Chairman.

[The complete prepared statement of Dr. Barnes follows:]

Statement by Harry G. Barnes Jr. Ambassador(retired) of the United States to Chile before the House Subcommittee on International Scientific Cooperation
May 2, 1989

Mr. Chairman:

I appreciate your asking me to take part in today's hearing on Interamerican scientific cocperation. As you know, I left Chile several months ago and retired from the Foreign Service. I am still, however, involved with matters relevant to the concerns of your committee through my work as a senior advisor to the U.S. panel of scinetists working on collaborative projects with Chilean scientists under the auspices of the American Association for the Advancement of Science and also through my work as a senior fellow of the World Wildlife Fund and Conservation Foundation. Today, however, I will be speaking essentially on the basis of my experience as American Ambassador to Chile from November 1985 to November 1988, a period during which a number of members of the committee came to Chile for the 25th anniversary celebrations of the Cerro Tololo Interamerican Observatory.

In your letter you asked for general comments on the proposed legislation and on three specific issues. Let me start with the specifics.

I believe scientific and technological cooperation can contribute to political stability in Latin America, primarily by enhancing the capabilities of Latin American scientists to address more effectively some of the serious problems these countries face. Granted the case of Chile is somewhat different because of the long period of decline in such cooperation between American and Chilean scientists; still the renewal of that cooperation in the last few years holds considerable promise in areas like sismology and oceanography and marine resources. My argument is essentially that one of the factors in political stability is a sense of confidence in facing problems and that that confidence in turn depends on having a number of capable, well trained people in key areas. The areas will vary from country to country, but certainly will include management of natural resurces, be they renewable or not, the environment, health problems, questions of importance in our own country as well.

Secondly, scientific and technological cooperation enhances trade relations between the United States and Latin American countries by virtue of enabling Latin American and U.S. scientists to remain in close touch and be aware of developments. That greater awareness in turn spreads through the society including the manufacturing and service sectors. They in turn are thus more aware of scientific and technological changes that influence trade decisions. The relationship is of course more often indirect than direct but is an area where information is a principal commodity. Widely shared knowledge potentially opens up many more possibilities for mutually advantageous trade. If you don't know what is going on, then you'll miss opportunities that count. To take a U.S.-Chilean example, let me cite the experience with the BITNET information system, a system used by many American universities. Through BITNET our own university research centers have links and linkages to Europe and Japan and as of a year and a half ago they have them to Chile as well. The link, thanks to the good offices of NASA, is between the University of Chile and the Univiersity of Maryland, and Argentine universities are now being tied in as well. Hence Chilean and Argentine scientists and their American counterparts are able reliably and quickly to exchange data and information and work out collaborative undertakings. What they know gets shared in turn in a much wider circle and means that the private sector firms as well know where to look for the technologies they need for their own plans.1)

Thirdly, with regard to to the level of interregional scientific cooperation, my own experience is that Chilean scientists are eager to renew and expand their cooperation with their counterparts, both in other Latin American countries and in the United States, especially as the country resumes a democratic system of government. A case in point is the work being done to promote the creation of a regional, Southern Cone, research center on the problems of the semi-arid areas with cooperation from the AAAS.

1)LASPAU's project with the American Chamber of Commerce in Chile is another important example, which I'm sure Mr. Tyler will touch on.

Speaking now in more general terms, and with reference to your question about the potential effcet of the proposed legislation on U.S. foreign policy, I would urge that not only in the title, but throughout its provisions, you be sure that it is conceived of as a cooperative venture.Both in terms of a decent respect for the opinions and interests of other countries in the hemisphere and in terms of achieving signficant results, the legislation will work best if it is truly mutually beneficial. I have seet to Ellen Salyers some specific suggestions for changes in the draft language to reflect that stress in philosophy. One example: give realities in Latin America, look at paragraph a(3) of section 2 , I agree it is very important for the United States to assert its interest in Latin America, but that is not the same as its"influence", a word that is used in the same section. Influence by itself still has too many negative connotations from the past of dominance. Influence in the sense of impact will in my view come much more effectively if it is an influence that grows out of mutual genuine cooperation in addressing common problems. So I would talk about a U.S. role and not of U.S. influence.

I believe that the legislation has important potential for inaugurating a period of substantial scientific and technological interchange between the United States and Latin American countries and among them as well, to the benefit of all concerned.

Mr. HALL. Yes.

I recognize Dr. Tyler.

STATEMENT OF DR. LEWIS A. TYLER, EXECUTIVE DIRECTOR, LATIN AMERICAN SCHOLARSHIP PROGRAM OF AMERICAN UNIVERSITIES, CAMBRIDGE, MA

Dr. TYLER. Thank you, Mr. Chairman.

I also would like to express my pleasure at appearing before the committee on the international scientific cooperation.

Mr. HALL. And let me say that each of your prepared bits of testimony will be put in the record; without objection from any of the members, it will be put in the record for a full reading by the committee and full use by the committee.

Now, go ahead, Dr. Tyler.

Dr. TYLER. Surely.

The comments and observations that I wish to make today are informed by 25 years of commitment to the development of universities in Latin America. 17 of those years I have spent with LASPAU, the organization that I represent today. From that standpoint, I speak from a development point of view rather than from a, strictly speaking, academic point of view or a scientific point of view.

If I may do so, I would like to say a couple of things about LASPAU. We are a nonprofit organization, and we are an allied institution of Harvard University in Cambridge. We are also incorporated in the Commonwealth of Massachusetts. We have an inter-American board of trustees. We have been concerned exclusively with institutional development, particularly of Latin American universities, for these 25 years.

We are best known for the support that we provide to exchange programs of USIA, AID, and resources from the World Bank or the Inter-American Development Bank. We are possibly best known for our work with the Fulbright program. There is a specific program called Fulbright/LASPAU, a faculty development program.

Over the years we have brought to this country over 4000 university faculty members from Latin America. We have an alumni roster of about 4500 people right now from throughout Latin America and the Caribbean.

I should note that LASPAU is a product of the major efforts of the '60s and early '70s. Our faculty development mission in fact was inspired by AID, the Agency for International Development.

Before I respond to the specific questions that I was asked to comment upon, I would like to make one or two general observations.

First, obviously, I want to congratulate the members of the staff and the members who are concerned and who have worked so diligently on this piece of legislation because to us at LASPAU, the board and the staff of LASPAU and the many institutions that we represent, it signals the end of more than 15 years of disregard, basically, for the importance of science and technological cooperation within the Americas.

In 1973, after devoting so many resources to institutional development in Latin America to universities and research centers, the

United States shifted its focus away from institution building and toward addressing the needs of the poorest populations of the Americas. The shift was abrupt and basically constituted then an abandonment of the policies that yielded such significant results, and I would like to just cite an example to illustrate the importance of that shift.

U.S. development assistance toward Brazil is a good case. AID and the U.S. Government are still today credited with the remarkable advances made in Brazil in the basic sciences, particularly in geology and chemistry. AID played a major role in the development of the two most important Brazilian centers for science and engineering, the Federal University of Rio de Janeiro and the Institute of Aeronautics Technology. This latter institute introduced to Brazil the American model of the graduate school.

This is not an irrelevant point. These institutional development activities were enormously successful. In spite of its problems, Brazil is still pumping out $35 billion worth of exports annually on an industrial base that could not have been built without the S&T support of the United States Government.

Since 1975, due to these policy changes throughout Latin America, of course, it has been impossible to defend investments in basic science development programs for Latin America as an appropriate development activity for AID, when rural health and basic education are obviously important areas of need.

I should note that LASPAU itself was a casualty. In 1975, at the point that the shifts in policy were made, it was determined that faculty development activities were programs that educated the educated, and LASPAU was disengaged from AID as a major funding source in 1975.

In the absence of large-scale U.S. investments and cooperative agreements in science and technology, we ask the question how have Latin American universities and research institutions fared since the early '70s, since the mid-'70s?

Again, in the case of Brazil, the national government very early on placed the development of graduate level education high on their national education agenda, and even in the midst of well-known economic turmoil that they have suffered from time to time, they have invested major resources into the development of their graduate schools, and they have achieved a high degree of sophistication in graduate education.

But they haven't done it by themselves. Today, Brazil's most important science and technology partnership is with West Germany, followed by France, Canada, Japan, East Germany, as well as with the Soviet Union and China. My associates in Brazil describe these countries as aggressive in their support of Brazilian science and technology.

Since 1987, the number of missions and agreements between Brazil and the Soviet Union and China have increased. It is now my understanding that China wishes to become a partner with Brazil in space research, and Brazil and the Soviets have signed a new two-year S&T cooperative agreement.

Again, my associates in Brazil say that the number of Soviet missions to Brazil to explore S&T cooperation is impressive.

In this regard, a great deal of interest is expressed here, as well as in Latin America, about Japan's role in science and technology development in the region. I had an occasion to visit Tokyo recently, where I raised the question with my Japanese, as well as Latin American, hosts about this question. Latin America, I was told by the Japanese, falls well behind their very high priority placed upon the United States—Asia first, the ASEAN countries, United States, and Europe both in terms of science development as well as in development assistance.

However, taking a look at the statistics of—well, I shouldn't say "however"—taking a look at the statistics, one sees that about 20 percent of their investments are dedicated to Latin America.

I was most interested to hear from my host, particularly the Latin American host in Japan, that it is their view that Japan's interest in development in Latin America in fact is derived from their interest in sustaining and supporting their U.S. markets. It is derivative; that is, they are not directly interested in Latin America, but they are indirectly interested in preserving the United States stability.

In fact, annual investment has increased nearly 200 percent between 1983 and 1988 in Latin America. The reasoning is instability in Latin America they feel leads to instability in the United States.

I was in Costa Rica a few days ago, where I was interested in the fact that Japanese interests had bought up 30 percent of the Costa Rican airline, a major hotel chain, and was now giving assistance to the national park system, scientific assistance, support assistance. Somewhere in this picture was included laboratory equipment donated to the University of Costa Rica. My host there also said that he shared the view that in fact their interest in Costa Rica is secondary; their primary interest was having additional access to Miami via the locks of the Costa Rican airline and also interested in pulling in the slack, making additional investments that the Costa Ricans themselves were unable to make.

I think it is worth noting here the interest of the private sector. As Ambassador Barnes just noted in Chile, the private sector via the American Chamber of Commerce was persuaded that the importance of science and technology development was of such high importance that they committed—a group of 15 member corporations committed themselves to a minimum of $150,000 per year on an annual basis for exchanges in science and technology. My experience in the 17 years of LASPAU is that was absolutely unprecedented in terms of the dimension and concern of the private sector.

In terms of potential benefits of renewed cooperation to U.S. and Latin American universities, I was intrigued by the suggestion of the SRI study that an effective way to gain access to the unique research and academic environments of Latin America is through one's graduate students. The relationship between the United States institution and the graduate returning to Chile or Brazil, or wherever, is a strong and important one from the standpoint of the U.S. university.

The second point is in ecology in Brazil, the two groups, the two Brazilian groups that are doing serious work in ecology are doing so under the umbrella of West German interests. Our scientific community should be there as well. It is of direct importance for the United States universities to have access to this kind of activity.

Third, as it currently stands, the U.S. trained—those graduate students who have been trained in the United States over the past several years are currently being used up, in a sense, by the other bilateral arrangements between Brazil, Western Europe, and Japan.

Historically, the Latin American university has provided professional training with a focus on applied rather than theoretical disciplines, and the absence of a scientific tradition in the university has hindered institutional development. The typical university continues to train young people for the profession, and high level university based research is still exceptional.

The problem is a self-perpetuating one. Students are not prepared in the sciences, research itself is scarce, as well as jobs in the sciences for science graduates. No more than 5 percent of all graduates in Latin America currently are in the sciences. The first chemistry program in Venezuela is about 10 years old. Less than 30 percent of the faculty conduct research. Not coincidentally, there are few jobs available in the scientific disciplines outside the university.

Important changes have taken place in the Latin American university, many of them the consequence of U.S. support of university development during the '60s. Universities now strive to engage full-time faculty, to be of true service to their communities, and perhaps most important, to develop their teaching and research capabilities in the sciences and technology. They are now more than ever a suitable target for development assistance and cooperation.

Currently, the universities' share in national research and development budgets varies, from some 50 percent in Costa Rica to about 17 percent in Chile. Just under 30 percent of Brazil's research and development budget is devoted to university-based efforts.

The important point in all of this is to build a long-lasting and self-perpetuating infrastructure in science and technology. The universities' share of national investment in research should be of the highest priority. The ability to provide new generations of capable scientists will be the direct consequence of that investment. The Inter-American Scientific Cooperation Act reflects the understanding that training of university faculty may be the means for the most lasting impact upon scientific and technological development in Latin America.

The formal relationships between the United States and Brazil, when translated into the movement of people and dollars and cents, amount to about the equivalent of the relationships between Brazil and Spain or Italy or Czechoslovakia or Hungary. Yet the informal relationships; that is to say, the numbers of students who come to this country from Brazil, are extremely important. Our leadership in scientific and technological disciplines continues to attract large numbers of graduate students, researchers and faculty through personal or Latin American government sponsorship. That is particularly true of Brazil. The nature of this informal relationship is changing, however, and the following statistics illustrate that change.

Thirty years ago, about 25 percent of all foreign students in this country were from Latin America. That percentage has declined steadily, and today 12.5 percent of all foreign students are from Latin America.

In 1982, there were 56,000 Latin American students in the United States, and last year there were just 44,000, or slightly more.

Since 1985, when statistics began to be gathered on this question, Latin America has stood out as sending the lowest percentage of graduate students. About 25 percent of all Latin American students are at the graduate level as compared to 54 percent from Asia.

Fewer than 5 percent of the undergraduates are government sponsored, and just over 20 percent of the graduate students here are under official sponsorship.

I understand the concerns of the subcommittee regarding employment opportunities for Latin American students who return to their countries. I share this concern. It is crucial because Latin American economies are suffering from under- and unemployment.

First, I tend not to be terribly concerned about the students who come here on their own nickel. The same resources that they have to come here will be useful in arranging their productivity when they return home. I think the real concern is about the professional futures of sponsored scholars. The administrators of the large undergraduate scholarship programs for Central Americans in the Andean area are learning the very simple lesson that LASPAU learned some 25 years ago; that is, if the student you select to come to the United States doesn't have a job when he or she leaves the country, there is no job awaiting that person upon return. And I don't really believe it is the responsibility of scholarship programs or of government to find jobs for sponsored students. So from the point of view of cost and management, it is my judgment that the effective approach is to sponsor those who are professionally employed and to require local institutional support that includes a financial contribution to the scholar during his or her studies and certainly a guaranteed position upon return home.

The legislation calls for scholarships for American students, and I understand that the members are concerned about what American students will find in Latin America.

The United States universities hold a comparative advantage over Latin American counterparts, certainly. It is my guess that in the rarest of instances would a U.S. citizen choose to conduct a full four years or five years of study in a Latin American university, but it seems to me that access isn't really the problem. There are many excellent opportunities for graduate students in Latin America, and there are literally dozens of exchange programs, study abroad programs that are conducted and managed by U.S. universities in Latin America. The problem is really one of demand, it seems to me. U.S. students rarely, if shortsightedly, believe that a career in science, business or engineering is enhanced by speaking a language besides English or working in another country.

This latter point causes me to think about other issues that influence our ability to respond to the challenge of reinvigorating inter-

American cooperation in science and technology, and I am struck by the enormity of the challenge.

We are not really a people that particularly likes to live abroad or learn about other cultures or learn other languages, and from what we see today, we are apparently not even a population that likes to study math and physics.

Our engineering schools and science departments are mostly staffed by foreign nationals, who in some instances are now returning home to develop the science and technology capacity of their own countries, and there is a vigorous and unresolved debate regarding access of foreign nationals to research environments in which there are security implications.

Nevertheless, speaking as one who has dedicated his professional life to the development of institutions in Latin America and the Caribbean, this legislation is the most encouraging statement I have heard from Congress in years, and I haven't forgotten for a moment the amount of the authorization. It doesn't come near the $170 million that were earmarked at AID to bring Latin American undergraduates to this country to experience America, and I should note that the cost of supporting an undergraduate student are comparable to the cost of supporting a graduate student. In fact, much can be done with 5- or $10 million. I estimate that about 300 Master's Degrees could be sponsored with $10 million.

This legislation is such an important first step that I decided weeks ago I didn't care how much was appropriated. The terms of the legislation are broad and sound, and while they are mindful of the benefits to the United States, they are responsive to the needs of our neighbors and respectful of their contribution to this collaborative effort, for which reason I thank you very much for the opportunity of being here.

[The complete prepared statement of Dr. Tyler follows:]

Statement of Lewis A. Tyler, representing the Latin American Scholarship Program of American Universities, Inc. (LASPAU)

Mr. Chairman, I am Lewis Tyler, Executive Director of LASPAU, the Latin American Scholarship Program of American Universities, an allied institution of Harvard University. I am pleased to appear before the Subcommittee on International Scientific Cooperation to comment on the "Inter-American Scientific Cooperation Act of 1989."

The comments and observations I wish to make are informed by 25 years of concern for the development of and association with Latin American universities, including 17 years with LASPAU. My remarks therefore reflect a developmental, rather than an academic or scientific point of view.

LASPAU is a non-profit organization located in Cambridge, Massachusetts, affiliated with Harvard University. We are incorporated in the Commonwealth of Massachusetts and are governed by an inter-American board of trustees. We are concerned almost exclusively with institutional development in Latin America and the Caribbean, and the work we do is generally that of providing management and other educational services to scholarship and training programs. Most of our work is conducted under contract to the U.S. Information Agency (USIA), the Agency for International Development (AID), the Inter-American Development Bank, and the World Bank.

We are best known for our work as administrators of scholarships, and for 25 years the core of our concern has been "faculty development," expressed through a variety of programs that have brought more than 4,000 faculty members from universities in Latin America and the Caribbean to this country. The faculty development mission of LASPAU was established, in fact, by the Agency for International Development, once keenly concerned about the development of universities and science and technology, but whose own priorities shifted to the support of basic education and away from universities in the mid-1970s. We are probably best known today for the support we provide the Fulbright Academic Exchange Program.

I have been asked to comment on specific areas of the proposed legislation, and before I do, I would like to comment on the general significance of the legislation.

The members and staff who have worked so hard to develop this legislation deserve our gratitude, for the Inter-American Scientific Cooperation Act of 1989 signals the end of more than fifteen years of official disregard for the importance of scientific and technological cooperation within the Americas. In 1973, after devoting important resources to institution-building programs, with significant support devoted to universities and research centers, the United States shifted the focus of its foreign assistance efforts away from the development of elites toward solving the needs of the poorest sectors within the developing world. This abrupt shift abandoned policies that had yielded significant results.

The case of Brazil illustrates the importance of early U.S. development assistance and some of the consequences of the shift in U.S. policy:

The U.S. government, through the Agency for International Development is today credited with many of the remarkable advances achieved in Brazil in the basic sciences, particularly in geology and chemistry. In the sixties and early seventies AID played a major role in the development of several institutions, including the two most important Brazilian centers for science and engineering - the Federal University of Rio de Janeiro and the Institute of Aeronautics Technology. This Institute, in fact, introduced to the rest of Brazil the model of the U.S. graduate school. This is not an irrelevant point, given the dimension of success of these institutional development activities. Brazil, in spite of its many economic problems has a booming export economy, pumping out 35 billion dollars worth of exports annually on an industrial base that could not have been built without the S&T support provided by the U.S. in the sixties and early seventies. Because the development of Brazil's industrial infrastructure depended so heavily upon the metalworking and chemical industries, Brazilian industrial strength is not an incidental byproduct of the S&T investments.

The next stage of Brazil's development will depend upon the new technologies, heavily emphasizing electronics, microbiology and research in the new materials. Yet since 1975, due to the policy changes in U.S. development assistance, it has been virtually impossible to defend investments in basic science development programs as an appropriate development activity for AID, because S&T programs are seen to contradict the core concern for agriculture, health, basic education and rural development. (LASPAU itself was a casualty of the shift in priorities; from 1967 to 1975 LASPAU was the Latin American university faculty development program of AID, in which the sciences and engineering were the main priorities of AID as well as the Latin American universities. By 1975 AID considered university development as "educating the educated" and disengaged LASPAU.) Again, this legislation "legitimizes" the sciences and technology in a way that has not been possible for more than fifteen years.

EUROPEAN AND JAPANESE S&T INVESTMENTS IN LATIN AMERICA

In the absence of large-scale U.S. investments and cooperative agreements in science and technology, how have Latin American universities and research institutions fared since the mid 1970s? Referring again to Brazil, the national government very early on placed the development of graduate level education high on the national education agenda, and even in the midst of recent economic chaos, much has been achieved in Brazil with Brazilian resources. But Brazil has had a great deal of help from her friends. Today, Brazil's most important S&T partnership is with West Germany, followed by France, Canada, Japan, East Germany, as well as with the Soviet Union and China. My associates in Brazil describe these countries as "aggressive" in their support of Brazilian S&T. Since 1987 the number of missions and agreements between Brazil and the Soviet Union and China have increased. It is my understanding that China wishes to become a partner with Brazil in space research; and Brazil and the Soviets have signed a new two-year S&T cooperative agreement. Again my associates in Brazil say that the number of Soviet missions to Brazil to explore S&T cooperation is "impressive."

In this regard, much interest is expressed here (and in Latin America) about Japan's current and future role in S&T development in the region. On a recent visit to Tokyo I raised this question with my Japanese (and Latin American) hosts. Latin America, I was told, falls well behind Asia, the ASEAN countries, the United States, and Europe in Japanese interest in scientific collaboration or even in terms of development assistance. Indeed, statistics of the Japanese development agency show that only about 20% of their development assistance resources is destined for Latin America. However, Japan's interest in Latin America is growing dramatically. Annual Japanese investments in the region increased nearly 200% between 1983 and 1988. I was interested to hear from long-time Japan observers from Latin America the view that by taking on a greater share of the burden for economic growth in Latin America, Japan not only cultivates Latin American markets for Japanese products, Japan protects the U.S. markets for her products. Reasoning: Japan is contributing to stability in Latin America, where instability, they feel, leads to instability in the United States.

I was in Costa Rica a few days ago, where again I was interested in the fact that Japanese interests had bought up 30% of the Costa Rican airline and a major hotel chain, and it was now giving assistance to the national park system, while somewhere in this picture was included contributed laboratory equipment for the University of Costa Rica. My host there also shared the view that Japan's interest in Latin America is derived from its interest in protecting its U.S. markets.

Knowing of the subcommittee's interest in arrangements to fund exchanges in the sciences that are creative, this may be an appropriate place to mention the Fulbright-AMCHAM-LASPAU program to which Ambassador Barnes referred in his testimony. The American Chamber of Commerce of Chile, the Chile Fulbright Commission and LASPAU have developed a fellowship program in the sciences whereby no single entity bears total responsibility for the costs. Through contributions of its members, the Chamber provides the program costs. The Fulbright Commission provides local administration and covers all administrative costs, and LASPAU arranges tuition coverage from its member U.S. universities.

POTENTIAL BENEFITS OF RENEWED COOPERATION TO U.S. AND LATIN AMERICAN UNIVERSITIES

The implications of SRI study were intriguing, in that the study showed clearly that an effective way for the U.S. universities to gain access to unique international research environments is through foreign graduate students. The continuing relationship between U.S. universities and Latin Americans returning home with graduate degrees can be powerful in terms of collaborative research. As the number of Latin American science and engineering students in our graduate schools would increase through this legislation, so, too, would opportunities for cooperative activities in the future.

A second point can be illustrated with another example from Brazil. If the two largest and most important scientific groups working on ecological issues in Brazil are doing so under a West German scientific umbrella, this legislation will give the U.S. university an opportunity to be there as well.

As it currently stands, we are short on "counterparts" - U.S.-trained scientists and engineers who can work with our universities on collaborative endeavors - precisely because they are already working on the many bilateral S&T arrangements with Europe and Japan. This legislation will provide the U.S. university with those counterpart scientists and engineers.

With regard to the Latin American university, historically, it has provided professional training with a focus on applied rather than theoretical disciplines, and the absence of a scientific tradition has hindered meaningful institutional development. The typical university continues to train young people only for the professions, and high level university-based research is still exceptional.

This problem is a self-perpetuating one. Students are not prepared in the sciences, research itself is scarce, and so are jobs in the sciences for science graduates. No more than 5% all graduates in Latin America are in the sciences. The first chemistry program in Venezuela is only about ten years old; there, less than 30% of the faculty conduct research. Not coincidentally, there are few jobs available in the scientific disciplines outside the university.

Nevertheless, important changes have taken place in the Latin American university, many of them the consequence of U.S. support of university development during the 1960s. Universities now strive to engage full-time faculty, to be of true service to their communities, and perhaps most important, to develop their teaching and research capabilities in the sciences and technology. They are now more than ever before a suitable target for development assistance and cooperation.

The impact of this legislation will vary from country to country, depending upon the role of the university in research and development. Currently, the universities' share in national research and development budgets varies, from some 50% in Costa Rica to about 17% in Chile. Just under thirty percent of Brazil's research and development budget is devoted to university-based efforts.

To build a long-lasting, self-perpetuating infrastructure in science and technology, the universities' share of national investment in research should be of the highest priority. Particularly by investing in the university can we ensure the creation of new generations of capable scientists. The Inter-American Scientific Cooperation Act reflects the understanding that training of university faculty may be the means for the most lasting impact upon scientific and technological development in Latin America.

RECENT TRENDS IN THE LEVEL OF LATIN AMERICANS STUDYING IN THE U.S.

Formal relationships between the United States and Brazil, when translated into the movement of people and dollars and cents, amount to the about the equivalent of the relationships between Brazil and Spain or Italy, or Czechoslovakia or Hungary. Yet through "informal" relationships, United

States leadership in the scientific and technological disciplines continues to attract large numbers of graduate students, researchers and faculty through personal or government sponsorship. One of the consequences of the debt crisis to Latin America, and to the U.S. university, is the change in this informal relationship. The following statistics illustrate that change:

Thirty years ago, 25% of all foreign students in this country were from Latin America. That percentage has declined steadily, and today 12.5% of foreign students are from Latin America. In 1982 there were about 56,000 Latin American students in the United States; last year there were about 44,000. Since 1985, when statistics began to be gathered on this question, Latin America as a region has stood out as sending the lowest percentage of graduate students; about 25% of all Latin American students are at the graduate level. (The region of the world with the highest proportion of graduate students is Asia, at 54%) Fewer than 5% of the undergraduates are government sponsored and just over 20% of the graduate students are here under official sponsorship. (Open Doors, Institute of International Education - various years)

OPPORTUNITIES FOR LATIN AMERICAN STUDENTS UPON RETURN HOME

I understand the concerns of the subcommittee regarding employment opportunities for Latin American students who return to their home countries. This is a crucial area of concern, because Latin American economies are suffering from serious un- and underemployment.

First, I tend not to be particularly worried about those students who have personal resources to come to the United States. Those same resources will be useful to arrange employment when they return home. Rather, and this concern may be shared by the subcommittee, we should be concerned about the professional futures of sponsored scholars. The administrators of the large undergraduate scholarship programs for Central Americans are learning the very simple lesson that LASPAU learned 25 years ago: if the student you select to come to the United States does not have a job when he/she leaves the home country, there is no job to go home to. (And I don't believe that it is the responsibility of the U.S. government or of scholarship programs to find jobs for sponsored students.) From the point of view of costs and management, it is my judgment that the effective approach is to sponsor those who are already professionally active and to require local institutional support that includes a financial contribution to the scholar during his/her studies as well as a guaranteed position upon return home.

STUDY OPPORTUNITIES FOR U.S. STUDENTS IN LATIN AMERICA

This legislation calls for scholarships for American students, and I understand the Members are concerned about what American students will find in Latin America. Frankly, because United States universities hold the comparative advantage over their Latin American counterparts, it is my guess that in the rarest of instances would a U.S. citizen, for reasons of program content, choose a Latin American university for a complete degree program.

On the other hand there are many excellent research and study opportunities in

Latin America for students in U.S. graduate programs, just as there are dozens of excellent year-long study-abroad programs for U.S. students in Latin America. The problem is not one of access, but one of demand. U.S. students rarely, if shortsightedly, believe that a career in science, business or engineering, for example, is enhanced by speaking a language besides English, or working in another country. If enacted, the challenge posed by this legislation is to find the students to go to Latin America.

This latter point stimulates me to think of other broad issues that influence our ability to respond to the challenge of reinvigorating inter-American cooperation in science and technology, and I am struck by the enormity of the challenge.

We are not a people that particularly likes to live abroad and learn other languages and about other cultures. Apparently we are not even a population that today likes to study math, physics and engineering. Our engineering schools and science departments are mostly staffed by foreign nationals, who in some instances are now returning home to develop the science and technology capacity of their own countries. The migration of talent (the "brain drain") plagues countries like Mexico, whose scientists are moving to countries who can provide scientific support and can afford to pay attractive salaries. And there is a vigorous and unresolved debate regarding access of foreign nationals to U.S. research environments in which there are security implications.

Nevertheless, speaking as someone who has dedicated his professional life to the development of institutions in Latin America and the Caribbean, this legislation is the most encouraging statement I have heard from Congress in years. And I haven't forgotten for a moment the amount of the authorization. It doesn't come near the $160,000,000 or so in AID earmarks to bring Latin American undergraduates to "experience America" (and I wish to emphasize that the costs of supporting graduate and undergraduate students are comparable). But much can be done with five or ten million dollars. (More than 300 master's degree programs can be provided with ten million dollars). This legislation is such an important first step that I decided weeks ago that in some ways I didn't care how much was appropriated. The terms of the legislation are broad and sound, and while they are mindful of the benefits to the U.S., they are responsive to the needs of our neighbors and respectful of their contribution to this collaborative effort.

Mr. Chairman, again I wish to thank you for the opportunity to appear before the subcommittee today.

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, DC 20515

SUBCOMMITTEE ON INTERNATIONAL SCIENTIFIC COOPERATION

HEARING ON H.R. 2152
The "Inter-American Scientific Cooperation Act of 1989"

May 2, 1989
2:00 P.M. - 4:30 P.M., 2325 Rayburn HOB

Witness List

Panel 1

Ms. Catherine Ailes
Director, Science and
Technology Policy Program
SRI International
Arlington, Virginia

Dr. John Boright
Director, International Division
National Science Foundation
Washington, D. C.

Panel 2

Hon. Harry Barnes (Former
Ambassador to Chile)
Peacham, Vermont

Dr. Lewis Tyler
Executive Director
Latin American Scholarship Program
of American Universities
Cambridge, Massachusetts

Dr. Moselio Schaechter
Chairman, Committee on
International Activities
American Society for Microbiology
Washington, D. C.

Dr. Leon Lederman
Director, Fermi National
Accelerator Laboratory
Batavia, Illinois

UNIVERSIDAD DE SANTIAGO DE CHILE
RECTORIA

26 April 1989

Dr. Lewis Tyler, Director
Latin American Scholarship Program
of American Universities (LASPAU)
25 Mt. Auburn Street
Cambridge, MA 02138

Dear Dr. Tyler:

I have heard of your personal interest in improved inter-American relations, and the good work of LASPAU toward that objective is well known. I hope to contribute a Latin American perspective to your efforts.

It is clear that science and technology will continue to develop in the USA. What is not entirely clear is how the Latin American countries can contribute to and benefit from, that development. At present, they seem likely to lag systematically and dangerously behind. Our principal institutions (government, universities, business, industry and labor) must find ways to cooperate and to share objectives and resources.

Human resources development is especially important, since an understanding of culture is fundamental to the advancement of scientific research and its applications. An important number of qualified Latin American scientists and engineers have received graduate training in the USA, and we would therefore expect to see a more direct cooperative relationship in the development of technology. There is at present a lack of commitment to programs that might support such objectives.

By steadily investing in better engineering, computer applications, advanced scientific research and business administration, we could strengthen and share in future responsabilities for the development of Science and Technology. The "industrial park" concept, with emphasis on science and technology research, in which three main partners contribute their experience and perspectives - universities, industry, investors- could provide a good starting point from which international scientific and technological linkages might provide not only good intentions but also implementation.

The above statements are based on the deep concerns of a Scientific and Technological University in but one South American country. I am certain, however, that many others share our views.

Sincerely,

RAUL SMITH
RECTOR
UNIVERSIDAD DE SANTIAGO DE CHILE

R21/T

Mr. HALL. Thank you, Dr. Tyler.
Dr. Schaechter.

STATEMENT OF DR. MOSELIO SCHAECHTER, CHAIRMAN, COMMITTEE ON INTERNATIONAL ACTIVITIES, AMERICAN SOCIETY FOR MICROBIOLOGY, WASHINGTON, DC

Dr. SCHAECHTER. Thank you very much, Mr. Chairman, for the opportunity to present the views of the American Society for Microbiology. I hope that these are views which are shared by other professional societies in this country. I know that there is a great deal of interest in this area of activity in other societies as well.

The granddaddy of us all is in fact the American Association for the Advancement of Science, which spearheaded some very notable activities, such as the Interciencia Consortium of Latin American and U.S. Scientists.

I would like to further acquaint you with us. We claim to be the largest biological society in the world. We have 35,000 members, of which 20 percent are from abroad, but only 1 percent from Latin America. In fact, the number was twice as much as shortly ago as 10 years ago, and this decline in the number of members from Latin America we attribute entirely to the economic stringency of those countries.

I would like to make a point with regard to the bill, which we strongly support, that, from perhaps a parochial point of view, can be seen as self-serving. We do think that microbiology is an extraordinarily important science because it does deal with the major problems which confront Latin American countries; namely, health, nutrition, and it also deals with issues which are of global concern; for instance, the preservation of genomic diversity.

I would like, however, to say a few things to you from a more personal point of view than what you have heard so far because I had the opportunity to visit—with a colleague to visit six Latin American countries a few years ago in an effort to determine in what way can a professional society be of use. This was sponsored by the American Society for Microbiology jointly with the AAAS.

What we found bears telling. It is my answer to a question, Mr. Chairman, that I received in your letter on how increased cooperation between the U.S. and Latin American scientific communities would benefit both.

Well, one has to first have some sense of who one is dealing with, and I suspect that we bring—I did bring to my trip and bring to this issue a series of notions, some of which turn out to be quite wrong. I was expecting to see in Latin America a great deal of hierarchical behavior in laboratories, of the professor being the boss and lording it over his underlings. I expected to see a very small amount of cooperation. All of that, in one form or another, was dispelled.

What my colleague and I saw in a number of laboratories; in fact, in all of the ones we visited, was quite the contrary—an openness, a desire to work together, and, what is more, an understanding of quality. We found, for instance, with regard to graduate programs, there are graduate programs in biology in Latin America, they tend to be very few, but the characteristic that they had is they are all very good. Surprise. To us this was news. We thought there would be a collection of second-rate programs all over, distributed all over the place, and that is not the case, and what we saw in general was that, for a whole lot of reasons, people were either doing things well or in general not doing them at all.

That is a probably a stronger statement than probably the facts deserve. It is not all that great, but to some extent we saw an amazing dedication to quality in every sense.

A lot of things were surprising; for instance, the number of women in position of leadership in science, in government agencies, in universities, and so forth, belie some of the stereotypes that we may have about Latin America.

Why am I mentioning this? Because I find it easy to imagine working with Latin American colleagues. When I tell my colleagues in my university or elsewhere about what we saw, their eyes light up. They say that is exactly what we would like to do and, what is more, they find a benefit and an interest in this, which is perhaps not surprising. Not only is it obvious that if you want, for instance, to study tropical diseases, you have to do it where the diseases are. There is no sense in trying to study Chagas' disease or leishmaniasis in the United States because those diseases don't exist here. But in addition, there is a spirit of quality and a spirit of dedication in Latin America which is something quite surprising.

So in talking about collaboration with Latin America, we are not talking about a stepping down in the human quality. On the contrary, we are dealing with people with whom we can do business in a very, very easy way.

So the level of interest that would be generated among American scientists in working with Latin American colleagues will demand a better acquaintance with them because I don't think that everybody knows this. It is a slight surprise to some of us that in fact there is a revolution of cultural values going on in Latin America which can be seen by other indicators such as the increased democratization and many other things.

So with this in mind, I believe that we can only gain from increased cooperation with Latin America in every sense possible.

I was asked to comment about the benefit to scientific societies for a program such as the one proposed in your legislation. Well, it is quite clear the membership in our society could go up by a very significant factor and with it would not only be an increase in our coffers through the membership fees, but an increased contribution to our journals by Latin Americans, an increased participation in scientific meetings, an increase in research, and from every point of view we would gain in every one of our programs.

So in conclusion, I would like to say that the American Society for Microbiology very much supports this bill. In particular, we do agree with the involvement of the National Science Foundation because we do believe that it has the appropriate experience and administrative capability to increase what it is doing, but we do think that this is the right agency of government to be doing this.

We do recognize, however, that the magnitude of the task is enormous, and we do believe that the size of the budget is insufficient to carry out more than a small part of the work that needs to be done.

This is probably a very realistic proposal, considering the fiscal strictures under which we must operate, but we believe, therefore, that this bill, should it be enacted, should be seen as having a strong pilot program component; that should not be the cost of carrying out programmatic activities. We support the demand for a reporting activity to the Congress by the National Science Foundation. It is very important because it would serve to indicate what really the magnitude of the task might be seen from the point of view of the National Science Foundation.

So again I thank you, Mr. Chairman, for the opportunity to express these views, and I commend you for having finally broken an ice jam in this business.

Thank you.

[The complete prepared statement of Dr. Schaechter follows.]

PUBLIC AND SCIENTIFIC AFFAIRS BOARD
AMERICAN SOCIETY FOR MICROBIOLOGY
1913 I STREET, N.W.
WASHINGTON, D.C. 20006

Testimony of Moselio Schaechter, Ph.D. at a hearing of the Subcommittee on International Scientific Cooperation of the United States House of Representatives held on May 2, 1989 on "The Inter-American Scientific Cooperation Act of 1989".

My name is Moselio Schaechter. I am professor and chairman of the Department of Molecular Biology and Microbiology of Tufts University Medical School in Boston, Massachusetts. I am here as chairman of the Committee on International Activities of the Board of Public and Scientific Affairs of the American Society for Microbiology.

The American Society for Microbiology (ASM) is the single largest biological organization in the world, with nearly 35,000 members. ASM represents scientific and technical interests in all phases of Microbiology, including basic, medical, agricultural, industrial, and environmental. ASM is an international society, as seen by its 6800 foreign members, or about 20% of the total. The proportion of articles published in the nine ASM journals from foreign contributors is now 35% of the total and, in keeping with trends in all science, is on the rise.

ASM has an ongoing and abiding interest in United States-Latin American science and technology. About 330 of our members reside in Latin America, exclusive of Puerto Rico. This number is down from a high of 539 in 1982, undoubtedly reflecting the economic crisis in most Latin American countries. By comparison, the number of ASM members in Great Britain is 401 and in Japan 398.

The most visible activity of ASM in the region is the Latin American Professors Program that each year covers the expense of travel and lodging for 8-10 U.S.

microbiologists to teach courses and workshops. The subject matters have encompassed clinical, agricultural, and basic Microbiology. Planning for these courses takes place with persons designated as coordinators in the host countries. Most of these courses include hands-on experience and are taken by microbiologists at different levels of training.

We are currently developing a long range plan of action to enhance interpersonal contacts among microbiologists of this hemisphere, make journals and books more readily available, and establish an Interamerican Microbiological Information Service that will electronically link existing and new networks. We are also fostering the establishment of sister department relationships.

To obtain further information about the state of Latin American Microbiology, a colleague, Dr. Cristián Orrego, and I undertook in 1987 a fact-finding trip to six South American countries to identify needs and lay groundwork for collaborative efforts. The countries visited were Argentina, Bolivia, Chile, Ecuador, Peru, and Venezuela. In each country we met with representatives of the academic community, national Microbiology societies, and government officials. Our report to ASM (Orrego, C. and M. Schaechter, *Enhancing Interamerican Cooperation in Microbiology*, ASM, Washington D.C., 1987) made the following points:

1. Latin American microbiological research and graduate training are small in quantity but tends to be of high quality. Our personal contacts confirmed published indicators of success under adversity, such as the fact that grants submitted to NIH from Latin America have the same average ratings as those from Europe (Orrego, C., 1984. In: *Biotechnology in the Americas: Prospects for Developing Countries*. W.D. Sawyer, ed. Interciencia Association, Washington).

2. Research in Latin American microbiological laboratories tend to be carried out in an unusual atmosphere of collaboration and cooperation. Rather than the authoritarianism of old, there is an increased demonstration of genuine collegiality between members of research teams. The need for parsimony in the use of equipment and supplies has bred the ready sharing of facilities and care in the design of experimental protocols. Interestingly, a large proportion of high academic and administrative

positions are held by women. These indicators gainsay some of the stereotypes associated with Latin American culture and support the view that Latin America is undergoing a genuine revolution of cultural values.

3. Unfortunately, these conditions coincide with a pattern of weakening of U.S.-Latin American links in research programs, graduate and post-graduate training opportunities, and networking and other information sharing techniques, including journal distribution. One of the factors weakening these links has been the decrease in funding and the change of emphasis in the United States Government participation in multilateral efforts in science and technology. Although funding from foreign sources is a small part of the total, it has had a profound influence on Latin American science

The rewards for being part of the scientific and technological endeavors of the Latin American community are great. The worldwide quality and quantity of research in the basic sciences is increasing relative to the U.S. and links with the scientific community in Latin America cannot be taken for granted. If the U.S. does not expand its links with Latin American science and techonology, other technologically and scientifically advanced countries (e.g. members of the European Economic Community and Japan) most surely will. If, on the other hand, the U.S. does develop an in depth program of assistance in Latin America, there will be access to microbiological strains and other biological collections which hold as yet unknown resources. For example, it has been estimated that as many as 80-90% of the soil microbes have not yet been cultured and identified. Latin American soil is rich in microorganismsand plants seen nowhere else in the world. Several examples of drugs known to all of us which have their origin in Latin America are chloramphenicol, quinine, curare and pilocarpine (used in glaucoma). The genetic resources, genomes of both plant and animal life, again found nowhere else on earth, are needed to maintain genetic diversity, and therefore genetic strength. Perhaps nowhere is this more important than in grain crops, essential to all nations, and an area in which genetic diversity is constantly being sought.

Scientists from this hemisphere will be able to network and exchange ideas, materials and students, all of which hasten advancement of ideas. New opportunities for all countries concerned will be seen where none could be found without such interaction. Finally, the United States will be able to help influence and mold international policy decisions related to science and technology throughout the hemisphere.

The ASM strongly supports the proposed Inter-American Scientific Cooperation Act of 1989. We believe that the intent of the bill is sound and the proposed mechanism for its execution practicable. We support the involvement of the National Science Foundation, an institution with appropriate experience and administrative capability. However, we must recognize the magnitude of a task whose scope embraces all aspects of science and technology. Thus, we are concerned that the size of the proposed budget will be insufficient to carry out more that a small part of the work needed. Considering the fiscal strictures under which such programs must operate, this is a realistic proposal for the next two years. However, we wish to state our belief that this should be serve partly as a pilot program. We hope that, in addition to fulfill its programatic needs, this effort will serve to assess the future funding level commensurate with the need.

Mr. **Hall**. Thank you very much, Dr. Schaechter.

Now, of course, we are honored to hear from Dr. Lederman.

You might know that the last Nobel Prize winner that this subcommittee had a chance to visit with was Professor Rubbia, and we visited with him onsite in Lucerne, oh, about a year ago, I suppose.

We are honored to have you, Dr. Lederman. We recognize you for your presentation.

STATEMENT OF DR. LEON LEDERMAN, DIRECTOR, FERMI NATIONAL ACCELERATOR LABORATORY, BATAVIA, IL

Dr. **Lederman**. Thank you very much, Mr. Chairman. You sure know how to put me at my ease. [Laughter.]

Mr. **Hall**. I believe you are easier to talk to than Professor Rubbia was. [Laughter.]

Dr. **Lederman**. Well, he did some studying with me way back a long time ago, so there might be some connections.

Mr. **Hall**. Well, you have both made great contributions, and we appreciate you.

Now, we will recognize you.

Dr. **Lederman**. Thank you.

Let me prefix my remarks by saying I agree with everything that has been said on this panel. I am very enthusiastic about this bill.

You might ask why a laboratory devoted to the exotic of quarks and the forces of nature is concerned with Latin America, and I think the answer has to be that it is in part a personal one, that throughout my professional life I have traveled in many laboratories and met Latin American scientists. Mostly they were refugees, fleeing from unstable political situations back home, but I was always impressed by the fact that if things looked at all good they would go back and try again.

So that when I joined the Fermilab and noticed the vast amount of technological things that go on in the process of doing these experiments, I thought this would be an excellent place where Latin American scientists and engineers could come for a stay, learn something about whatever techniques they thought were interesting and useful for them back home, become acquainted with how we do things in a national laboratory, the atmospherics, if you like, for combinations of engineering and intellectual activities, I was somewhat inspired by an institute in Trieste organized by Abdus Salaam. This was a theoretical institute for developing countries. We thought something devoted to hardware and experimental science would be even more useful.

And the process went on, one thing led to another, and we have a very vigorous program. We currently have about 50 visitors from some 10 Latin American countries. They come for periods of three or four months all the way up to two years, and they do just what we anticipated they would do. They roll up their sleeves, they go to work with our groups, we learn something from them because they are enthusiastic, bright, and they pick up things from us and they go back home and we get telephone calls: e.g. Please send us that Westinghouse catalog I saw on Joe's desk.

So they have connections, and we keep those connections.

Some years ago we were startled by the crisis of hard currency in one of our meetings in Brazil, and we came back and pleaded with various agencies, and the National Science Foundation under a previous Director came up with $300,000, which it took us about three years to spend in pieces of $500 here and for subscriptions to journals, for small equipment parts, for urgent travel. The mail we have gotten as a response to that particular grant was just incredible, and how much a small amount of money can do.

So I enthusiastically concur with the general thrust of this bill. I believe fully that science and technology are the paths to development—I testified before the parent committee in detail on this subject—above and beyond the gains to us of having greater political stability, of having a more sophisticated set of customers for our products and a greater choice of products for our consumers.

There is also the subtle point that was perhaps made. The planet is facing a tremendous set of technologically induced problems, things like acid rain and deforestation and ozone depletion, greenhouse effect, global oil spills, and so on and so on, and one doesn't have much imagination to think of new things that one can write down that have not yet caught the popular press, things that will face us in the twenty-first century, and yet all the things that we are experiencing now really support only about 20 percent of the industrialized population of this planet, and there is another 6 billion people coming up in the rest of the world who also want to enjoy the good life, and solutions will clearly require world cooperation. That is one point, but the other thing they will require is the essence of human creativity and creativity that is nurtured wherever it is found.

So I don't think we can afford in some sense to lose those rare people—the Einsteins and Jonas Salks and inventors, and so on—just because they are born out of reach of a society that can find them and educate them and nurture them and put them to use for the planet.

So for many, many reasons I think it is to the benefit of this nation and the planet to improve the state of the world, and we can do best in Latin America. It is closest to us. It is a culture—it is strongly influenced by the same culture we have. Science in Latin America started about the same time it started in the United States, but political instability and various other problems prevented it from keeping up with us.

The one thing I would like to single out for special discussion, even though all the clauses are interesting and are valid, has to do with the universities and the human resources, and that is an idea I have been working on for some time in very spare time, and that has to do with the notion of a much larger program. I look at this as a visionary program, if you like, and try to estimate what we could do for the potential graduate students in Latin America, and I think ultimately, if I look at the numbers of PhD's in Latin America now and I look at the quality universities that are already there and the need to keep those good and keep them improving, that we can absorb something like 10,000 graduate students, perhaps even 20,000 graduate students a year. That would sort of saturate the requirements for graduate student study in Latin America in all of the sciences and in engineering.

What should such a program do?

It would be clearly on a scale different from that proposed here, but as someone mentioned before, we would like a program that grows, and this might be a direction in which it could grow.

First of all, all the money would be spent in the U.S. So politically it would be advantageous. It would clearly be a financial boom to U.S. universities to have paying graduate students. Four years of study and research in the U.S. would create generations of scientists and engineers in Latin America who would inevitably supply the movers and shakers and influentials of these nations as they embrace science and technology on their road to development.

These U.S.-trained experts would think U.S. products, U.S. modes of organization and management, and we heard eloquently the problem of competition, which I think we should engage in because this is the good kind of competition. We should do it with some zest.

Of course, as most of my colleagues here have stressed, we have to do this with enormous sensitivity. We have to take care of the universities and make sure that ultimately the need for our graduate schools will decrease as their own universities grow to encompass this.

There are many other places where we have to be extremely sensitive and in fact stressing the mutual advantage of this kind of a program and spelling it out, and gradually the situation will become more symmetric. As their universities improve, more American students will want to go down there and become more of an even thing.

An optimistic extension of these very Utopian ideas leads to a bustling, prosperous, and ever-growing Pan-American society.

The big problem I think has already been mentioned by the reaction of the National Science Foundation, is the sources of the funding. That is why I made the bizarre suggestion that perhaps this is an important issue that no only affects science and technology and education, but also affects foreign affairs, as Mr. Brown has pointed out, and perhaps the right source of money is our 11- or $12 billion of foreign aid because clearly that is where I think one could justify the expense. If one took it from the science budgets of the National Science Foundation, clearly at the level in which this committee wants to go and the higher levels which most of the panelists are urging, that would be painful for the National Science Foundation.

We need a good source of this kind of funds. Foreign aid seems to be the right source. It also has this enormous base, and probably one can find wiser ways of spending some of that money.

So to summarize, I certainly support the aims of the proposed legislation. I think it is an important piece of science, for education and for foreign policy. I think I understand the wisdom of starting small, and I hope one can structure the bill so that large growth can follow. I think the U.S. will gain, Latin America will gain, and the planet will gain.

Again by stressing science training, I don't mean to diminish the advantages of the other parts of the bill. I think, as I pointed out, very small sums of money have a very large leveraging effect at this time.

Thank you.

[The prepared statement of Dr. Lederman follows:]

Testimony of Leon M. Lederman
Committee on Science Space and Technology
Subcommittee on International Scientific
Cooperation
May 2, 1989

Mr. Chairman I'm pleased to testify here in favor of the Inter-American Scientific Cooperation Act. I am the Director of the Fermi National Accelerator Laboratory, a Department of Energy facility located in Batavia, Illinois. Our mission is to carry out research in high energy physics, dealing with the exotica of quarks, leptons, the forces of nature, the structure of space and time. Research at Fermilab is based on the world's highest energy particle accelerator, the TEVATRON. We have a staff of some 2000 but the scientific research is carried out by some 1300 scientists from 70 U.S. and 60 non-U.S. institutions, 400 non-U.S. scientists come from 17 foreign countries.

The accelerator, computers, particle detectors required for this frontier scientific research represent state of the art technology in such diverse fields as superconductivity, control systems, new computer architectures and so on.

Some eight or so years ago I began a series of meetings with colleagues in Mexico, Colombia and Brazil offering hospitality to Latin American scientists and engineers. The notion was to build bridges with the physics groups in the more developed of the developing countries, mostly nations that started science about the same time we in the U.S. started but, because of political instability, were left behind, especially in the post WWII epoch. We were dealing with countries with a strong European heritage and this cultural affinity lead to relatively easy communication.

Well, one thing lead to another and today we have a lively interchange with about 50 visitors currently in residence at our Lab from 10 Latin American countries for periods of up to two years. Much to our surprise, three groups, two from Brazil and one from Mexico have organized to become participants in our particle physics experiments, and a fourth (from Colombia) is starting. Most of the others join one of our technical groups, become familiar with a relevant technology and return home to teach and make use of their new-found skills in their own institutions. In an Appendix, I list the many different programs we have with Latin America. However the comments I will make on the proposed legislation has, as its background, our fairly extensive experience as indicated above. Let me just summarize this by saying that these collaborations have had clear benefits to Fermilab and to our colleagues in Latin America.

We have shared our technical expertise and the atmospherics of a national laboratory at the cutting edge of basic research. We have had the benefit of gifted young people who have rolled up their sleeves and given of their talent and enthusiasm. Now to the proposed Inter-American Scientific Cooperation Act.

To begin with I enthusiastically concur with the general thrust of the Findings as listed in the Sec. 2 of the Act. In particular my experience tells me that a closer collaboration between the U.S. and Latin America in science training and research can indeed be mutually beneficial. I believe that science begets technology and technology begets development which then encourages more science. Development will serve to diminish the severe social and economic problems, leading to greater political stability and, for the U.S., a more sophisticated set of customers for our products and a greater choice of products for our consumers. I have already testified before this full Committee (April 11) on the close coupling of science, technology and development. Above and beyond these gains is the more subtle point that the planet is facing a tremendous set of technologically-induced problems e.g. acid rain, deforestation, ozone depletion, greenhouse effect, global oil spills, threatened shortages of fossil fuels, high grade ores and so on. Crises of the 21st century not yet upon us but which can be imagined will certainly include the prospect of supporting 8 billion people most of whom have not participated in the good life which has, in one way or another, generated the problems we listed. The solutions require world cooperation, but also require the utmost in human creativity and the nurturing of that creativity wherever it is found. The planet can no longer afford to lose its rare Einsteins, Jonas Salks, Alexander Bells, etc. just because they are born in dirt floor cabins in the forested provinces of Brazil or Ecuador. By assisting the scientific growth of our hemispheric neighbors we increase the base out of which will come the geniuses that will help solve our problems and improve the quality of our life.

For many years now I have been trying to sell the idea which is contained in essence but not in scale in the Sec 3, item (2) which charges NSF with "activities which shall include graduate and post-graduate fellowships for Latin Americans in science and technology study in the U.S." I would like to single this out for special discussion even though many of the other clauses are interesting, exciting and parallel, remarkably, the kinds of activity we at Fermilab have been instigating in our very small way (see Appendix).

The U.S. in its excellent universities, has a very impressive excess graduate student capacity. With a reasonable attention to distribution we could absorb some 10-20,000 graduate students with no pain. Some number like this would in fact saturate the needs of all of Latin America for graduate study abroad in science, engineering and mathematics. Such an extensive program, could have incalculable advantages to our nation. All the funds (some $300M annually, including tuition and subsistence) would be spent in the U.S. It would clearly be a significant boon to U.S. universities. Four years of study and research in the U.S. would create a generation or two of scientists and engineers in Latin America who would inevitably supply some of the movers, shakers and influentials of these nations which must embrace science and technology on their road to development. These U.S. trained experts would think U.S. products and U.S. modes of organization and management.

All of this must be done with enormous sensitivity. One example is the need for Latin American universities to grow and begin to take a larger role in training their own citizens. My impression is that currently, about half of Latin American Ph.D.'s are trained abroad. Germany and the UK were primary locations because of low tuition but this is changing. Gradually, the situation can become more symmetrical as better Latin American schools and increasing scientific opportunities will decrease the need for U.S. assistance and in fact attract U.S. students to Latin universities. An optimistic extension of these utopian ideas leads to a bustling, prosperous and ever growing Pan American society.

The proposed legislation takes an important step in this direction. The weakness seems to me is in the absence of scale. Clearly a significant program must define significant funds. At a minimum of $20,000 per student, how many is a reasonable start? Does NSF take these out of its FY90 budget? What must be given up? My question to this Committee and the framers of the legislation is: at any level in which the program starts, from where do the funds come? In an ideal world, HSST would forge an alliance with Foreign Affairs and make this a tax on foreign aid. Then, significant numbers of students would have a very small effect on the total sums involved. However if NSF is to service even a few hundred students a year, at $20,000 a student, this is a significant sum.

To summarize, I wholeheartedly support the aims of the proposed legislation. It is a very important piece of science, of education and of foreign policy. I understand the wisdom of starting small but I hope one can structure the Bill so that very large growth can follow. The U.S. would gain, Latin America would gain, the planet would gain. By concentrating on the science training I do not by any means intend to belittle the other components of the Inter-American Scientific Cooperation Act. It is an Act of statesmanship and wisdom. Thank you.

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Appendix

Fermilab Programs in Latin American Collaboration

A. Visitors to Fermilab

Fermilab has been host to many Latin American scientists who come for periods ranging from days to years; they have been from both the more developed and the less developed countries of the region. Some come to work in our Theoretical Physics or Astrophysics groups; some are experimenters using our facilities, and coming either as members of the Latin American high energy physics groups discussed later, or as current members of U.S. university groups. Some come for short-term Fermilab post-doctoral research appointments. There have also been several engineers sent here to acquire experience with the state-of-the-art equipment we use; so far, we have had six electronics engineers from Brazil, Mexico and Argentina, staying typically 1-2 years, and working on such activities as new data acquisition systems and our Advanced Computer Program.

Attachment I contains a listing of some fifty Latin American scientists currently at Fermilab.

B. Meetings in Latin America

Fermilab has sponsored meetings in Latin America, particularly on high energy physics, but also on physics teaching and advanced computers. Our contribution has involved, for example, obtaining travel support from U.S. government agencies for U.S. participants, and assistance in arranging for U.S. speakers. Noteworthy amongst these meetings has been the series on Pan American Collaboration in Experimental Physics, of which the fourth is to be held in November 1989 in Bariloche, Argentina.

C. Visits to Latin American Institutions

Many Fermilab staff members have travelled to Latin American institutions to give seminars and courses on current activities in physics, to help in starting high energy physics groups there, and to spend sabbaticals there. Interest has also been expressed in Fermilab sending engineers to lecture on advanced work in their fields. We have cosponsored Conferences on Teaching of Modern Physics in Mexico and Colombia.

D. Ph.D. Program

The CINVESTAV institute in Mexico wants to start a program in experimental high energy physics, but at present has limited staff and facilities. We are assisting towards this goal by currently having three of their graduate students carry out high energy physics research here, under the supervision of Fermilab staff members; if the students are successful in their work, they will be awarded Ph.D.'s by CINVESTAV.

E. High Energy Physics Groups

Over the past five years, Fermilab has actively helped in the formation of three Latin American high energy physics groups, all of whom are now users of Fermilab facilities. These groups are from UNAM, Mexico; CBPF, Rio de Janeiro, Brazil; and Sao Paulo, Brazil. We gave much assistance initially, lending them equipment and assisting with housing, salaries etc., whilst their scientists were at Fermilab. We have had discussions with other Latin American institutions which are interested in the possibility of also starting high energy physics groups.

F. Used Books and Journals

For several years, we have collected used books and journals from Fermilab staff for distribution to Latin American institutions of higher education. About once a year, a list is sent to some 25 institutions, and typically about 60 boxes of materials are shipped each time. We created a science library in one Central American university on the library of a deceased U.S. physics professor.

G. NSF/APS Grant for Latin American Physics

At a physics conference in 1983 in Latin America, the financial crisis and shortage of foreign exchange in the region was a subject of much discussion. It was realized that a relatively small amount of money could make a substantial impact in overcoming the effects of the crisis on the growing scientific infrastructure of the most developed countries of the region. For example, if it is not possible to obtain a spare part, costing a few dollars, for a large piece of research equipment, the whole research project could be halted. An estimate of a need for about $300,000 per year was made. This eventually led to a one-time grant of $300,000 from the National Science Foundation (partially funded by the Department of Energy) to the American Physical Society, with Dr. Lederman as one of the principal investigators. By arrangement with the Department of Energy, the grant was administered by Fermilab.

The five countries receiving assistance were Argentina, Brazil, Chile, Mexico and Venezuela. The funds, which were all expended in the U.S., were for per diem expenses in the U.S. during visits for conferences or collaborative research; page charges for publications in U.S. journals; subscriptions to U.S. journals; and small equipment items. Representatives in each country solicited and selected requests from physicists in their countries, which were then transmitted to the U.S. administrators.

(8)

All of the funds were expended by the end of 1986; the sheaf of letters we have received from Latin American scientists acknowledging its crucial importance to their research and pleading for its renewal is heart-rending. In return for dollars invested, it must be among the finest pieces of U.S. foreign aid.

LATIN AMERICANS AND IBERIANS ASSOCIATED OR IN COLLABORATIONS WITH FERMILAB IN JULY OF 1988

	Country of Origin		Experiment or Division	Mail Station	VAX Username	Telephone Extensions
Gilvan Alves	Brazil	Visiting Physicist	E769	122	CARNAVAL	4096,3821,4036
Joao Anjos	Brazil	Visiting Physicist	E769	122	J_ANJOS	4096,3821,3225
Carlos Avila	Colombia	Visiting Physicist	E710	122	AVILA	2415,2350
Clicerio Avilez	México	Visiting Physicist	E690	122		4107
Miguel Awschalom	Argentina	Resident Physicist	Accel	347	AWSCHALOM	3455
Carla Barros	Brazil	Visiting Engineer	E769	219	BARROS	4096,3821,3225
Edgar Black	Ecuador	Resident Engineer	Mech	221	BLACK	4710
Juan Bofill	Venezuela	Resident Physicist	E741	223	BOFILL	3258
Oscar Calvo	Argentina	Visiting Engineer	Accel	308	CALVO	2157
Milciades Contreras	Chile	Visiting Physicist	E741	223	CONTRERAS	4600,4601,3137
Walter Correa	Perú	Visiting Engineer	E690	122		4107
Marcos Dillenburg	Brazil	Visiting Engineer	Resear	222		2541
Carlos Escobar	Brazil	Visiting Physicist	E761	219	CESCOBAR	4103,3600,4128
Miguel Fachin	Brazil	Visiting Engineer	Resear	222	FACHIN	2541
Graciela Finstrom	Ecuador	Resident Technician	Tech	316	GRACIELA	4645,3982
Marcelo Gleiser	Brazil	Visiting Theo. Physicist	Astro	209	GLEISER	4494
Bernardo Gómez	Colombia	Visiting Physicist	E710	122	GOMEZ	2415,2350
Ricardo Gómez	Colombia	Visiting Physicist	E672	221		2042
Héctor Gonzalez	Puerto Rico	Resident Engineer		222	GONZALEZ	4658
Rodolfo Gonzalez	Colombia	Resident Technician	Accel	308	ALVARO	2127
Jesse Guerra	México	Resident Technician	Resear	221		4305
Philippe Gouffon	Brazil	Visiting Physicist	E761	219	PGOUFFON	3139,3600,3601
Gastón Gutierrez	Argentina	Resident Physicist	E690	122	GASTON	4107
Carlos Hojvat	Argentina	Resident Physicist	E735	122	HOJVAT	4400,2344,2343
Moyses Kuchnir	Brazil	Resident Physicist	Tech	316		3368
Angel López	Puerto Rico	Visiting Physicist	E687	221	ANGEL	2185,2184,2183
Roberto Mahon	Brazil	Visiting Physicist	E761	219	MAHON	3139,3600
Sirley Marques	Brazil	Visiting Theo. Physicist	Astro	209	MARQUES	2378,3758

	Country of Origin		Experiment or Division	Mail Station	VAX Username	Telephone Extensions
Manuel Martín	Spain	Resident Engineer	Accel	308	MANUEL	3859
Joao Mello Neto	Brazil	Visiting Phycisist	E769	122	J_MELLO	4096,3821,3225
Héctor Méndez	Chile	Visiting Physicist	E687	122	MENDEZ	4124,2183
Jussara Miranda	Brazil	Visiting Physicist	E769	122	J_MIRANDA	4096,3821,3225
Mariano Miranda	Brazil	Visiting Engineer	Comp	227		
Antonio Morelos	México	Visiting Physicist	E761	219	MORELOS	3139
Gerardo Moreno	México	Visiting Physicist	E605	122	FIRST	4934
Jorge Morfín	México	Resident Physicist	Resear	220	JORGE	4561
Helio Motta	Brazil	Visiting Physicist	E769	122	MOTTA	4096,3821,3225
Juan Pablo Negret	Colombia	Visiting Physicist	E710	122	NEGRET	2415,2350,2373
Angela Olinto	Brazil	Visiting Theo. Physicist	Astro	209	OLINTO	3665
Augusto Oliveira	Brazil	Visiting Physicist	E769	122	OLIVFIRA	4096,3821,3225
René Padilla	Puerto Rico	Resident Technician	Accel	306		4352,4420
Gustavo Pérez	Honduras	Visiting Theo. Physicist	Theo	106		
José Poces	Spain	Resident Engineer		333	POCES	3279
Joao Pulido	Portugal	Visiting Theo. Physicist	Theo	106		4163,3766
Alberto Reis	Brazil	Visiting Phycisist	E769	122	A_REIS	4096,3821,3225
Filiberto Rodriguez	Honduras	Visiting Physicist	Safety			
Alexandro Salvarani	Chile	Visiting Physicist	E665	356	SALVARANI	3706,2087,2088
Alberto Santoro	Brazil	Visiting Physicist	E769	122	SANTORO	4096,3821,3225
Miguel Sarmiento	Perú	Visiting Physicist	E760	341	MIGUEL	4277
Bruno Schulze	Brazil	Visiting Engineer	E769	122	SCHULZE	4096,3821,3225
Moacyr Souza	Brazil	Visiting Physicist	E769	122	SOUZA	4096,3821,3225
Jaime Stein-Schabes	México	Visiting Theo. Physicist	Astro	209	JSSI	3662
Leticia Stein	México	Visiting Mathematician	E741	318	LETTY	2169
Jorge Uribe	Colombia	Visiting Physicist	E690	122	E690JU	4107
Eugenio Valdés	Cuba	Resident Engineer	E740	214		3624
Arnaldo Valderrama	Venezuela	Resident Engineer	Comp	227	ARNALDO	2155
Roberto Vignoni	Argentina	Visiting Engineer		222	VIGNONI	3551
Carlos Yosef	Colombia	Visiting Physicist	E706	221	CARLYO	2263,3969,4891
Manuel Zanabria	Perú	Visiting Physicist	E687	221	ZANABRIA	4124,2183,2184

Mr. HALL. Thank you, Dr. Lederman.

Okay, now, Ms. Ailes, if you will come on back up. Is there a chair up here for you? If not, I know that everybody here will help you get a chair, and I hate to ask you, Dr. Boright, but you come on up here, too. [Laughter.]

I feel kind of sorry for you, but the panel is sure you will handle yourself as you always do.

We will get underway by asking—there are so many questions that we want to ask, but I think I could just start off with Dr. Lederman and this question will be to each of the gentlemen.

You have heard Dr. Boright's testimony that the current level of the U.S.-Latin America S&T cooperation is about right and that new programs and legislation are not needed.

Is that basically, Dr. Boright, your position?

Dr. BORIGHT. No.

Mr. HALL. Why don't you tell them what your position is? Then I am going to ask them what they think about it. How is that?

Dr. BORIGHT. I think that the trade-off that we have made within the existing NSF budget, where we are trading off against lots of other things, which I should say are also underfunded, seriously from the point of view of a lot of us, I think the trade-off is probably about right.

The overall funding, of course, I would advocate it being higher, certainly, in total loyalty to the Administration's position, can still say that the President would like it to be on a doubling trajectory over a four-year period, and we are not doing it.

Thank you.

Mr. HALL. Dr. Lederman, would you like to start by commenting on that?

No one just beat up on him, but just a few words.

Dr. LEDERMAN. I think he is a match for all of us. He is doing very well.

But I don't believe that—I think you have to stress the fact that the million dollars, if it comes out of sort of other funds—I happen not to be supportive of the National Science Foundation, but many of the universities that use our laboratory are, and it seems to me that the needs of the program are in the level of much higher sums of money. I think that the million dollars can do a lot of good, but that $10 million is that much better, and as I think it was illustrated here, I believe that the real program is in the level of hundreds of millions of dollars.

It is a shocking thing to say these days, but I think in the menu of a great nation there are a lot of things that we have to consider doing and giving priority to, and the problem of improving the state of our close neighbors, our hemispheric neighbors is to my mind an extremely important activity, and I think the $1 million is important but it is only a token for what we really need.

I am sure that if it weren't for the conflict of other pressing activities that obsess an agency like the National Science Foundation, that would be generally recognized.

I think that is a policy issue which in part Congress has to play a role in shaping as the priorities for what we do in things like this.

Mr. HALL. I was interested in your comment in your testimony where you propose a tax, as I understand it, on foreign aid to subsidize enlarged fellowship programs.

Could you call it anything other than a tax? [Laughter.]

Dr. LEDERMAN. A revenue enhancement, sir.

Mr. HALL. Yes. The fellow that is in the White House over there has said something about that, and I think it would be hard to keep him out of the loop on this. Do you have any other——

Dr. LEDERMAN. I think a right way to say it, what I really meant was a percentage perhaps of our foreign aid.

Mr. HALL. Of allocating part of the foreign aid toward this?

Dr. LEDERMAN. Yes.

Mr. HALL. George cleared his throat. I don't think he liked that. Is that agreeable to you, Congressman from California?

Mr. BROWN. That is perfectly okay.

Mr. HALL. All right. Thank you, Dr. Lederman.

Dr. Schaechter.

Dr. SCHAECHTER. Well, I can only echo what Dr. Lederman said, but I would like to add it seems to me there is an opportunity for Congress to make sure that the $10 million don't come out of Dr. Boright's hide, that this should be earmarked as new money and not as money to come from existing funds.

I can't believe that the need, the programmatic need is anything like what can be met with existing funds, and again I think what Dr. Lederman said is, in my view, absolutely right in the biological sciences. I would have no problem seeing how $100 million a year could be spent very easily on very worthwhile frontline programs.

Mr. HALL. Yes, because Dr. Boright is not on real thin ice when he states a view that fellowships for foreign students at U.S. schools would cut into the fellowships available for deserving U.S. students. That is something I think most of us agree with.

And what you are talking about is an addition, and I doubt that Dr. Boright believes that is politically possible, but that it would be good, and that is your suggestion.

Dr. SCHAECHTER. Yes.

Dr. LEDERMAN. That is just why I used foreign aid instead of, say, the Department of Education.

Mr. HALL. Right, okay.

Dr. SCHAECHTER. Sir, may I add another?

Mr. HALL. Yes, sir.

Dr. SCHAECHTER. I must call Dr. Boright to task on one item. I am not sure I know why he objects to the bill on account of decreasing flexibility of the NSF. Certainly if it is new money added on, it seems to me that the way the bill is written it is quite broad in scope and does not mandate a precise programmatic straitjacket.

Mr. HALL. I might be mistaken, but I understand that if it is new money and it is added on that Dr. Boright is not here objecting to it.

Dr. BORIGHT. Right. That is the context in my reference to flexibility. Simply when you have a fixed pool and you start earmarking money within the pool you reduce flexibility.

Mr. HALL. All right, my time is up. I was going to get Dr. Barnes, Harry Barnes, but I may get back to you.

So I recognize the Ranking Republican Member, Ron Packard from California.

Mr. PACKARD. Let's see if we can get back to the basic position that we find ourselves in now.

Dr. Boright, you say you have $13 million in this category of your budget, total, and that is for all foreign assistance, is that correct?

Dr. BORIGHT. NSF is not in the business of foreign assistance in the usual sense. Virtually all of that $13 million goes to the American side of collaborative research. So, it is for international cooperative activities, but the people who propose and who actually receive the money are the American side of the cooperation

Mr. PACKARD. And $1.2 million of that $13 million is earmarked for Latin American assistance, is that correct?

Dr. BORIGHT. That is how much we spent last year.

Mr. PACKARD. And if this bill passed, assuming that this does not incorporate new monies; in other words, 5- to $10 million of new monies, then your position is that this would take the lion's share of your total $13 million, or could take at least from half up to almost 70 percent of your $13 million simply to accommodate this kind of legislation?

Dr. BORIGHT. I don't really know what would happen. That is too much pain to even contemplated——

Mr. PACKARD. Yes, you couldn't do it. It would wipe out your——

Dr. BORIGHT [continuing]. Because it would eliminate, among other things, just to start the list, our entire effort to insert American presence into the Japanese research and development.

Mr. PACKARD. And I think the members of our other panels and other members at the table would agree that it would be inexcusable for us to mandate that you take up to $10 million out of the total $13 million for Latin American assistance.

So I take it from the testimony of the rest that you are also, as Dr. Lederman, looking at new funds rather than earmarking these existing funds for this purpose, which I think brings us much closer to really the debate, whether we can get new funds and, if not, what is an appropriate share of the $13 million budget that Dr. Boright has to earmark to the Latin American cause.

What do we spend in other countries, developing countries other than Latin American countries, other than this type of aid, Dr. Boright?

Dr. BORIGHT. The overall distribution of that $13 million is not spent very much in developing countries, to be direct. Something over a million dollars is spent in a U.S.-China program. Something over a million is spent in the U.S.-Japan program, which is augmented, by the way, with quite a lot of Japan resources that we get to use. We spend a comparable amount, somewhat more, in cooperation with supporting Americans who are cooperating with counterparts in Europe.

What we are now supporting in cooperation in Africa, in particular, frankly is pathetically small; with the countries in the Pacific RIM other than China, the poorer developing countries, again it is very small.

So this $1.2 million is well over half of what we are spending for cooperation with counterparts in any of the developing countries.

Mr. **Packard**. Ms. Ailes, in your testimony you described the reasons for the decline in U.S. science and technology cooperation in Latin America.

Do you have any information on the amount of cooperation that we are participating with other nations, such as the European and Pacific RIM countries?

Ms. **Ailes**. The amount that the United States is spending?

Mr. **Packard**. During this period of decline, have we information relative to the level of cooperation by other nations with Latin American countries?

Ms. **Ailes**. Mr. Packard, we do have some specific examples of activities that Europe and Japan have been undertaking with Latin America. Some examples are included in my full testimony.

We did not in the scope of our study look extensively at the activities of other countries. We concentrated primarily on U.S. involvement, as that had been what was requested in the directive.

Mr. **Packard**. Have you some idea as to whether we are lagging behind or whether we are comparable or ahead of most of their participation?

Ms. **Ailes**. Yes. My sense is that we do have lots of evidence that the United States has been declining in terms of its cooperation with Latin America. That evidence is from the declining number of students coming to the United States, few fellowships, other forms of assistance for students, the fact that many Latin American countries graduated from AID bilateral programs, and a flattening off in the number of NSF awards that involved cooperation with Latin America starting in the mid-'80s.

Throughout, the many people that we talked to in the course of putting together our study, there seems to be a lot of increase in what the Europeans and the Japanese are doing in Latin America. Dr. Tyler gave you some examples, particularly in the case of Brazil, a little while ago.

Japan currently has cooperative agreements with—science agreements with Mexico, Brazil, and Venezuela, I believe. Germany is reportedly offering more fellowships for Latin American students than it is able to fulfill.

I do back in my office have some materials on this, and I believe it is an important area, and I would be happy to provide the committee with some more information on this.

Mr. **Packard**. Thank you.

[The information follows.]

Federal Republic of Germany: Agreements on Scientific and Technological Cooperation with Latin America

"In development aid policy, the Federal Government is seeking new ways of scientific and technical cooperation with the developing countries so as to provide a contribution through research and technology to the economic and social development of the Third World. In the case of developing countries which have already established the beginnings of research capacity, cooperation on the basis of partnership is an important starting point in jointly defined research projects."

The table below "provides an overview of agreements concluded by the Federal Republic of Germany on scientific and technological cooperation" with Latin American countries.

Argentina

Governments	Outline treaty	Co-operation on scientific research & technological development	22. 10. 1969
KFK - Comisión Nacional de Energia Atómica	Individual agreement	Peaceful utilisation of nuclear energy	29. 7. 1971
DFVLR – Departamento de Investigación y Desarollo de la Fuerza Aérea Argentina (DID)	Individual agreement	Aero-Space research	15. 4. 1975
DFVLR – Comisión Nacional de Investigaciones Espaciales (CNIE)	Individual agreement	Wind energy, solar energy, space research	1. 11. 1978
BMI - Comisión Nacional de Energia Atómica	Agreement	Exchanges of technical information & co-operation in the sphere of safety at nuclear installations	8. 10. 1981

Brazil

Governments	Outline treaty	Co-operation on scientific research & technological development	12. 8. 1969
KFA – Comissao Nacional de Energia Nuclear (CNEN)	Individual agreement	Research into nuclear energy & technological development	23. 4. 1971
KFA – CNEN – Companhia Brasileira de Tecnologia Nuclear (CBTN)	Additional agreement	Integration of CBTN in the agreement of 23. 4. 1971	3. 10. 1973
DFVLR – Centro Técnico Aerospacial (CTA)	Individual agreement	Aero-Space research	18. 11. 1971

Brazil (continued)

KFA – Conselho Nacional de Pesquisas (CNPq)	Individual agreement	Scientific & technical research except for nuclear energy, aerospace travel, mathematics & data-processing	19. 11. 1971
GMD – CNPq – Secretaria Especial de Informática (SEI)	In addition to the GMD/CNPq agreement of 7. 6. 72	Data processing, information studies	1. 4. 1981
GMD – CNPq	Individual agreement	Mathematics & data-processing	7. 6. 1972
GMD – CNPq Commissao de Coordenaçao de Atividades de Processamento Eletronico (CAPRE)	Additional agreement	Integration of CAPRE in the agreement of 7. 6. 1972	24. 7. 1974
KFA – Empresas Nucleares Brasileiras. S.A. (NUCLEBRAS)	Individual-agreement	Utilisation of nuclear energy	3. 10. 1973
Governments	Treaty	Co-operation in the peaceful utilisation of nuclear energy	18. 11. 1975
DAAD – CNPq	Individual agreement	Exchange of highly-qualified scientists for research purposes	8. 8. 1976
Kiel Institute of Oceanography – Diretoria de Hidrografia e Navegaçao, do Ministério da Marinha (DHN)	Individual agreement	Marine sciences	1. 10. 1976
KfK – NUCLEBRAS	Individual agreement	Research into nuclear energy	1. 10. 1976
KFA – KWU – NUCLEBRAS	Individual agreement	R & D programme for utilising nuclear process heat in coal gasification	8. 3. 1978
KfK – CNEN	Individual agreement	Peaceful utilisation of nuclear energy	8. 3. 1978
KFA – Secretaria de Tecnologia Industrial do Ministério da Industria e Comércio (STI)	Individual agreement	Industrial technology	8. 3. 1978
BMI – Ministério de Minas e Energia (MME)	Agreement	Exchange of technical information & co-operation in the sphere of safety at nuclear installations	10. 3. 1978
BMI – MME	Agreement	Extension of the agreement of 10. 3. 1978	27. 7. 1983
KFA – NUCLEBRAS	Agreement	Utilisation of thorium in pressurized-water reactors	20. 3. 1979
KFA – Companhia Auxiliar de Empresas Elétricas Brasileiras (CAEEB)	Individual agreement	Coal utilisation & MARKAL energy model	11. 12. 1981

Chile

Governments	Treaty	Co-operation on scientific research & technological development	23. 10. 1970

Mexico

Governments	Outline treaty	Scientific & technological co-operation	4. 9. 1975
GSF – Instituto Politécnico Nacional (IPN)	Individual agreement	Co-operation on scientific research & technological development in biology & medicine	22. 9. 1975
BMFT – Secretaría de Asentamientos Humanos y Obras Públicas de los Estados Unidos de Mexico (SAHOP)	Special agreement	Co-operation on R & D in the utilisation of solar energy	2. 5. 1978
KfK – Instituto Nacional de Investigaciones Nucleares (ININ)	Individual agreement	Nuclear energy	4. 12. 1981
BMFT – Secretaría de Patrimonio y Fomento Industrial (SEPAFIN)	Individual agreement	Co-operation on the evaluation, development, & application of environmentally acceptable techniques of production	10. 2. 1982

Venezuela

Governments	Agreement	Co-operation on science & technology	28. 12. 1978
BMFT – Ministry of Energy & Mining	Special agreement	Technical co-operation in the energy sphere	16. 10. 1978

Key

BMFT – Federal Ministry of Research & Technology
BMI – Federal Ministry of the Interior
BML – Federal Ministry of Food, Agriculture, & Forestry
BMV – Federal Ministry of Transport
DAAD – German Academic Exchange Service
DFVLR – German Aero-Space Research & Experimental Unit, Porz
FhG – Fraunhofer Society for the Promotion of Applied Research e. V.
GKSS – Society for the Utilisation of Nuclear Energy in Ship-Building & Navigation mbH, Hamburg
GMD – Society for Mathematics & Data-Processing mbH, Birlinghoven
GSF – Society for Research into Radiation & the Environment mbH, Neuherberg
KFA – Nuclear Research Unit, Julich
KfK – Nuclear Research Centre GmbH, Karlsruhe
MPG – Max Planck Society

Source: Excerpts from Valentin von Massow, Organisation and Promotion of Science in the Federal Republic of Germany, 1986 Inter Nationes Bonn, pp 73-92.

Mr. **Packard**. One other question, Ms. Ailes.

As we have reviewed and even listened to testimony today, we have sensed, or at least I have sensed, that there is a lack of coordination, a lack of correlating activities on one agency in the U.S. Government with other agencies and with NSF, and in terms of their involvement in Latin America, often the one doesn't know what the other is doing and there is not a real coordination.

Is that something that needs to be addressed?

Ms. **Ailes**. That was one of the key findings of our study, that there are a lot of activities in the U.S. Government, in the private sector. They are maybe not at sufficient levels that we would like to see, but there is really not a lot of coordination that has been going on among these various programs, and perhaps with the same dollars that are even involved now they could be better leveraged by increasing the coordination of what is being done there.

In addition, many of the multilateral and regional organization representatives that attended various meetings that we held in the course of putting together this study noted that they have a problem in coordinating their activities with what is going on in the United States because they do not have a focal point within the U.S. Government or somewhere in the United States to know who to go to to try to work with in their efforts.

Mr. **Packard**. Is there anyone on the second panel that would recommend to Dr. Boright that we take a greater share of this existing budget in this category for the Latin American area? Assuming new funds are not available because of the tight budget constraints, would you have recommendations for a different distribution formula in terms of the $13 million as it relates to Latin America?

Would anyone have any suggestions of a different formula?

So basically your position is that we simply need to make a greater commitment to Latin America, and that would involve new funds.

I may come back with some additional questions, Mr. Chairman. I will let you take over.

Mr. **Brown** [presiding.] Yes.

While we are talking about other nations' role with regard to fellowships for Latin American students, do we know whether the Soviets are offering any programs in this area?

Any of you.

Dr. **Boright**. Yes, but I can't give you numbers. We can try to find some.

I think that generally some of the comments made by Mr. Tyler accord with my understanding of what is going on. The Japanese programs are very large, and in fact as large as they are in Latin America, they are dwarfed by Japanese programs in the Asian area.

Mr. **Brown**. I think we possibly have tended to put too much emphasis here on the level of authorization in this bill and not so much on the program itself, and in reading the bill again, I note that the program is intended to identify and cooperate with both private and governmental funding bodies, both in Latin America and the United States, which will bear a share of the financing of cooperative projects. There is further reference to the investigation of innovative financing of cooperative projects and distribution of such information in both areas and the coordination of information exchanges, including the development of library resources, funding of publications, and establishment of computer linkages.

Now, Ambassador Barnes, you mentioned something about establishing computer linkages. Dr. Lederman and Dr. Schaechter both mentioned work being done at the lab and by the Society of Microbiologists in encouraging efforts here.

I would like to know, Dr. Lederman, how did you finance those 50 people that you mentioned.

Dr. LEDERMAN. It was a good point. I thought my idea was so brilliant I would simply go to the Rockefeller Foundation and come away with bags full of money. It wasn't that easy. Ultimately, we are financing it out of the operating budget of the laboratory and justifying it on the basis—fully justifying it on the basis of the fact that the people who come to us earn their keep.

So in some sense we have chosen to spend some of our operating resources on Latin American scientists and engineers.

Mr. BROWN. You are getting cheap labor there?

Dr. LEDERMAN. In some sense that is right, and we think it is a bargain for us in that way.

Mr. BROWN. But that is at least an innovative idea.

Dr. LEDERMAN. Thank you.

Mr. BROWN. What I am pointing to here is the fact that what we really need is some focus in which we can develop broader programs that would encompass the goal here, and I get the reaction that NSF doesn't want to be the focus of a broader program even if it didn't take money out of existing budget categories.

Do you want to speak to that criticism?

Dr. BORIGHT. Yes, can I?

I think it is fair to say that NSF is a small organization and it is not the counterpart organization to Ministries of Science and Technology in other countries. The fact is we do not have a counterpart organization.

Mr. BROWN. Despite my bill to do so.

Dr. BORIGHT. Despite your bill, sir.

NSF and its management takes a lot of pride in spending only 5 percent of its budget on management of itself and passing on 95 percent. That has some implications for limitations of how much bureaucratic effort we can exert.

But within that, I really did want to say that if you picked up that impression I really didn't mean to leave it.

Mr. BROWN. Yes.

Dr. BORIGHT. Both the Director and the National Science Board and the various levels of the management of NSF have been focusing very recently in our long-range planning exercises and our conceptual work as to what we are about, very much much on the need to do some of the exact things that you have been talking about, to work more with other agencies, e.g. AID.

There clearly are overlapping interests. We have got to be able to get more mileage out of what we have got by working with other organizations, and I, myself, am spending somewhere around 15 or 20, or something like that, percent of my time just trying to make those connections, and with some success.

I think I could give you some examples, except we are running out of time, but clearly we are not resistant to that idea.

Mr. **Packard**. Would the Chairman yield for just a moment on his comments?

Mr. **Brown**. Certainly.

Mr. **Packard**. Does the bill—and maybe Mr. Hall, who has cosponsored this, reviewed it sufficiently, or the staff—does the bill address this at all in terms of earmarking either funds or certainly some effort in terms of coordination, enhancing the coordination?

Obviously, we are failing in that area to some degree, in coordinating the different funds that are being funneled to Latin America or to other areas, and that lack of coordination very well could involve a waste of money or a duplication of monies that could add up to significant amounts, maybe even equal to the $1.2 million that we are now spending.

I sense that this is a weakness that perhaps even this legislation may not address, and the question would be, would this be an appropriate place for us to address that?

Mr. **Hall**. [presiding.] I don't think that was addressed. We didn't want to set up another bureaucracy or even give that indication. We just didn't address it. We are willing to discuss it, though, when we come to mark it up.

Mr. **Packard**. The study has revealed and the recommendation has been made that we do something more than we are doing in terms of coordinating and correlating the efforts, and that is an area that we did not address and I suspect the bill doesn't address.

I yield back.

Mr. **Hall**. Are there——

Mr. **Packard**. I believe that Mr. Brown still had some questions.

Mr. **Brown**. Let me just finish my thought, Mr. Chairman.

I don't think, despite the fact that we normally write legislation in terms of directing an agency under the committee's jurisdiction, in this case NSF, to do something, that the committee is biased against having it done through a collaborative method. In fact, we are moving more and more in that direction, as is the National Science Foundation. You are trying to leverage your money over there with all sorts of collaborative efforts. This committee welcomes and encourages it.

What we would like to see, I think, is some mechanism by which we could do the same thing in terms of this tremendously important problem of enhancing the scientific and technological capabilities of Latin America and the benefits of closer collaboration.

Now, we don't pose that to you in terms of will you suggest how we can do that. We give you a bill and ask you to say what is wrong with it, and you are very good at saying what is wrong with it.

But is there any of you on the panel who could suggest how we could encourage more initiative, say, in the laboratories or in the professional societies or in the AAAS?

You all have excellent initiatives there. Can we bring about some way in which the good programs that you are doing can be more widely noticed and used as examples and stimulate other groups to do the same thing? If the physicists and the microbiologists can do it, why can't the astronomers and the seismologists do it?

There are a lot of things that are unique to Latin America that are of interest to these societies as well, and we are looking for ways to accomplish that.

Yes, Mr. Barnes.

Dr. **Barnes**. Let me suggest perhaps something that is obvious, Congressman, which is the technique of getting people together who are concerned about the problem and giving them the task of trying to come up with a mechanism that works and doesn't cost very much. There is the device known as the consortium or task force, or what have you.

When I was referring earlier to LASPAU or to the AAAS, in a sense some of the techniques we have used there were essentially getting together a group of people and finding ways of leveraging, depending on the access to funds or to ideas or to people that each group had.

NSF some years ago—you may remember this from the time we met in India—NSF some years ago had a special task force to work on various programs of cooperation in India and did a very good job. The main defect, though, I think was that it was limited to NSF and some of the agencies in government. I think something could be done which would take both the private sector, the university laboratories, and government to come up with some ideas on what would be the most appropriate mechanism now in these days of budget stringencies.

Mr. **Brown**. Well, I am—go ahead, Dr. Schaechter.

Dr. **Schaechter**. If I may, I would like to call to your attention that we are initiating a workshop which will take place at the end of July to do precisely what the Ambassador said. We have invited representatives of NSF, AID, and private organizations as well, foundations and professional societies to discuss how we can implement and together work in this area.

Mr. **Brown**. Yes. I noted just recently that the Chinese have taken tremendous advantage of the opportunity to send students over here. The figure is now somewhere around 50,000, as I understand it, from both Taiwan and mainland China, which is probably the largest of any country by far, and they are a poor country, and we are not paying for those if I am not mistaken. China pays the cost of that, do they not?

Dr. **Schaechter**. If I may, I believe that most of these people are graduate students and they come here, if accepted, on a stipend, a research fellowship, or some such, teaching assistantship, so they are actually being paid largely—in biology they are being paid largely from NIH money.

Mr. **Brown**. Is that right?

Dr. **Schaechter**. Yes, sir. But if I may add to this, there is an underground cottage industry in China which makes it possible for these people to apply because all their applications are alike and they are all very well written.

Now, for every hundred applications in my department we get from China we don't get as many as one from Latin America. So this cottage industry has to be revved up.

Mr. **Brown**. Can we develop a cottage industry in Latin America?

Dr. **Schaechter**. Yes, sir. Yes, sir, we believe that is where we come in. We believe that through our professional contacts with Latin America we can in fact effect exactly that.

Mr. **Brown**. We need a few more of these computer links down there, don't we?

Dr. **Schaechter**. Sir, you read our minds. That is exactly what we are working on, yes, sir.

Mr. **Brown**. Well, how about getting Apple to pay for them or somebody like that? There is a big market for computers once they got the network set up.

Dr. **Schaechter**. Yes, sir.

Mr. **Brown**. That exhausts my innovative ideas. [Laughter.]

Mr. **Hall**. I understand that Ambassador Barnes has to leave here within about another six minutes. I would really like to ask him about the recent grape cyanide scare that took place, but that would get into another subject.

We have no permanent problem there, though, do we, Mr. Ambassador?

Dr. **Barnes**. Mr. Chairman, I suppose I can speak very freely because I am no longer working in Chile, and therefore there is a lot I probably don't know at this point

My sense is, though, that despite the heavy impact on the Chilean fruit export industry, that the impact will probably not be serious over even the medium run, but it does raise questions about how easily international trade can be interrupted and what are the trade-offs. Some are more worried, in a sense, about the global implications than the specific U.S.-Chilean implications

Mr. **Hall**. Okay, do we have other questions? Congressman Packard?

Mr. **Packard**. I, too, have got a short schedule now, and so I won't belabor it

Dr. Tyler, I think you made the statement that half the students coming to the United States over the past—or that one-half of the students who have come to the United States in the last 30 years have been—I guess I didn't write down the entire scope of your comment. But at any rate, the question was why do you think that so many have—oh, that is it—that there has been decline and that half the number are now coming than were coming 30 years ago. Why the decline?

Dr. **Tyler**. The decline is financial; that is, the vast majority of students who come here pay for their own way and their ability to pay in hard currency has drastically been reduced.

Mr. **Packard**. And we are constantly also faced with a shortage of funds to assist our own student scientists, potential scientists and researchers in our own universities, and there is a call for additional funds constantly there. Also, we are constantly looking—as this committee, looking for additional funds for all science programs, including NSF and research, and so forth. We never get as much out of the appropriation process or out of the budget process as we would like as a committee, and if we ask for an additional $10 million in this area, or up to $10 million, it very well could be monies that would have to be siphoned away from other programs, scientific programs, and it becomes a question of priority for us and for the country in terms of where it best needs its money.

Do you believe that it would be more productive for us to train and teach and to subsidize Latin American students—and I may go along and feel that maybe that is the best use of the funds—or would it be a better use of our funds to increase our commitment to our own students and supplement them that cannot afford now to go into science programs?

Dr. TYLER. Why have you asked me such a hard question?

Mr. PACKARD. It is hard. It is hard to make those kind of priorities.

Dr. TYLER. I think it is an impossible judgment to call.

Mr. PACKARD. And, unfortunately, the Congress tends to deal with budget, in isolation. We deal with this program and we deal with that program, but there is never a time when, as a Congress, we come together and discuss what our priorities actually ought to be.

Dr. TYLER. I prefer to think of the appropriation of the amount of money that we are considering in this legislation here and compare it to the—again, I will refer to the 160- or $170 million that were earmarked for AID to invest in undergraduate scholarships for Central Americans and young people from the Andean countries, a vast amount of resources, and that is a consequence of the bipartisan Commission on Central America.

Mr. PACKARD. Surely, if the $10 million—and if that is the new money that we have to come up with to fund this kind of an effort and, as laudable as it is, would you, Dr. Lederman, be content to have this committee recommend that we take at least a portion of that $10 million out of the budget for Fermi?

Dr. LEDERMAN. You know, we get this question quite often.

Mr. PACKARD. Of course.

Dr. LEDERMAN. Often it is in the form, would you rather build a supercollider in Texas or feed poor people? And that is easier. That is the easiest way to answer. We say we would rather feed poor people.

That is often not the real choice, and that is why I use in my own testimony the phrase, "the menu," is that this is a great nation, it has a menu of activities. It does many things. It is compassionate. It feeds poor people. It does a large number of things, some of which are wise and some of which are foolish, and if I had my choice as to where to get $10 million, I would probably not take it out of Fermilab—I mean, I haven't decided that yet—I would probably find another place where I would argue persuasively that that is a better place to take it from.

And I think that is really the issue, is wisely judging our priorities, and when you take two very good things and you say would you rather do this or that, I think you are putting the issue in the wrong context clearly. I think you agree with me.

Mr. PACKARD. I don't disagree. I think most of you—I hope you all know that this committee has fought hard to increase funding for all science programs, and we have not been as successful as we would like to be, and I believe that if we felt it was doable, if there were new monies available, this committee would fight hard to get the additional $10 million, or whatever we could, to increase our efforts in Latin America.

But most of us recognize that to find new monies in our budget conditions now will be very, very difficult.

I have no more questions, Mr. Chairman.

Mr. Hall. Okay, thank you.

With Dr. Lederman not being able to answer this because I am going to rap the gavel down, I just want to say with his background experience and international recognition, he is going to make a great Texan, I hope. [Laughter.]

And I will also close with one other bit here, that we are talking about priorities.

Thank all of you so much.

Ms. Ailes, you did such a good job I don't think anybody questioned you, did they? But you have certainly made a good presentation.

And, Dr. Boright, you held your own and represented this country well here, and we thank you. I know of your background, and it has been one of success, and we appreciate having people like you on the firing line for us.

Mr. Ambassador, good to see you, Dr. Schaechter.

Thank all of you. Dr. Tyler, I appreciate your input.

And when we talk about priorities, we will close with a story that I heard, that a football coach at a great university came home and his wife was crying, and he said, what is wrong, honey? She said, well, you like football better than you do me. He said, yeah, but I like you better than I do basketball. [Laughter.]

So it is a matter of priorities, and you all have done a good job of helping us set our priorities into shape.

Thank you. This meeting is closed.

[Whereupon, at 4:25 p.m., the subcommittee was adjourned.]

APPENDIX I

I

101st CONGRESS
1st Session

H. R. 2152

To reinvigorate cooperation between the United States and Latin America in science and technology.

IN THE HOUSE OF REPRESENTATIVES

April 27, 1989

Mr. Roe (for himself and Mr. Hall of Texas) introduced the following bill; which was referred to the Committee on Science, Space, and Technology

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A BILL

To reinvigorate cooperation between the United States and Latin America in science and technology.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled,

SECTION 1. SHORT TITLE.

This Act may be cited as the "Inter-American Scientific Cooperation Act of 1989".

SEC. 2. FINDINGS AND PURPOSES.

(a) Findings.—The Congress finds the following:

(1) The diversity of Latin American countries and their needs in science and technology are profound and

should be recognized and understood in the United States.

(2) Opportunities for science and technology cooperation with Latin America have decreased significantly since the 1970's, when many countries in Latin America graduated from programs sponsored by the Agency for International Development.

(3) Latin American scientists and engineers have increasingly looked to Europe and Japan for advanced training and research. This trend, in conjunction with the emphasis on science and technology in Latin American national development plans and the increase in science and technology cooperation among Latin American nations, will mean a loss of United States influence if the United States does not act to reassert its interest in Latin America.

(4) Investment by the United States in the Latin American science and technology infrastructure and participation of United States scientists and engineers in short-term and long-term assignments in Latin America can strengthen United States influence in Latin America and contribute to many United States national goals, including scientific access, trade and investment relations, common security, and the opportu-

nity to contribute to economic development and political stability in the region.

(5) Science and technology cooperation with the United States, and advanced training and research in the United States, can bring many benefits to Latin America. In less advanced countries, cooperation can contribute to the strengthening of basic science and technology infrastructure. In industrially advanced Latin American countries, cooperation can increase opportunities in many scientific disciplines and in the frontier scientific fields.

(6) Considerable progress in science and technology cooperation can be made with relatively modest investments.

(7) Celebration of the quincentennial of Columbus' discovery and the return to democracy in a number of Latin American countries provide a focus for the reversal of the decline in science and technology cooperation with Latin America.

(b) PURPOSES.—The purposes of this Act are—

(1) to reinvigorate cooperation between the United States and Latin America in science and technology;

(2) to contribute to the development of scientific infrastructure throughout Latin America, both by building on existing centers of excellence and by creating

science and technology strength in institutions where none currently exists; and

(3) to establish an Inter-American Scientific Cooperation Program in the National Science Foundation to provide a focal point in the United States Government for science and technology cooperation with Latin America.

SEC. 3. ESTABLISHMENT OF THE PROGRAM.

The National Science Foundation shall establish an Inter-American Scientific Cooperation Program (hereafter in this Act referred to as the "Program") aimed at increasing the level of science and technology cooperation between the United States and Latin America. The Program shall identify and cooperate with private and governmental funding bodies, both in Latin America and in the United States, which will bear a share of the financing of cooperative projects. The Program shall include the following elements:

(1) Encouragement and funding of project development interchanges and joint research projects between United States and Latin American scientists and engineers.

(2) Establishment of an Inter-American Scientific Educational Development Fund. The Fund's activities shall include graduate and post-doctoral fellowships in science and technology for Latin Americans to study in

the United States and for United States citizens to study in Latin America; collection and dissemination of information to Latin Americans on other avenues for advanced study in science and technology in the United States; and United States assistance to Latin American institutions, ~~at the in~~stitutions' request, for development of courses, seminars, and curriculum in science and technology.

(3) Investigation of innovative financing of cooperative projects and distribution of such information to the United States and Latin American science and technology communities.

(4) Coordination of science and technology information exchanges between the United States and Latin America, including development of Latin American library resources, funding of publication costs, and establishment of computer linkages between United States and Latin American scientists and engineers.

(5) Providing information to enable the routing of United States scientific equipment to Latin America, including information with respect to matching equipment with need, identifying technical maintenance requirements, and meeting customs regulations.

(6) Promotion of research programs which utilize unique natural environments or existing centers of re-

search excellence in Latin America, such as the Charles Darwin Research Station in the Galapagos Islands.

SEC. 4. REPORT.

Each year at the time of submission to the Congress of the President's budget, the Director of the National Science Foundation shall submit to the Congress a report which—

(1) details activities conducted pursuant to this Act during the preceding fiscal year;

(2) describes plans for the current and upcoming fiscal years' activities;

(3) recommends priorities for cooperation in terms of scientific disciplines and geographic regions; and

(4) recommends necessary legislative or administrative changes in the Program.

SEC. 5. AUTHORIZATION OF APPROPRIATIONS.

There are authorized to be appropriated to the National Science Foundation to carry out the Program not to exceed $5,000,000 for fiscal year 1990 and not to exceed $10,000,000 for fiscal year 1991.

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INTER-AMERICAN SCIENTIFIC COOPERATION

HON. ROBERT A. ROE
of New Jersey
In the House of Representatives

April 27, 1989

Mr. Speaker, today I am introducing legislation -- the "Inter-American Scientific Cooperation Act" — designed to re-invigorate scientific cooperation between the United States and Latin America.

In the past two decades, political and economic turmoil has weakened the scientific infrastructure of many Latin American countries. Further, in recent years, as opportunities for science and technology cooperation between the United States and Latin America have decreased, Latin Americans have increasingly looked to Europe and Japan for advanced training and research. This erosion of United States involvement with Latin America concerns me greatly.

In July 1987, the Subcommittee on International Scientific Cooperation held a hearing to review the status of our science and technology relationship with Latin America. This hearing was followed by an oversight trip by the Committee on Science, Space, and Technology to five South American countries in January 1988. In the National Science Foundation Authorization Act for Fiscal Year 1988, the Congress directed the National Science Foundation to prepare a report that summarized current involvement and charted new directions for science and technology cooperation between the United States and Latin America. That report was issued in June, 1988.

Although the position of the United States in science and technology in Latin America has slipped, the hearing and trip showed us -- and the report confirmed — that Latin American interest in cooperation with the United States remains strong. Science and technology cooperation is one of the most productive ways for the United States to contribute to economic development and political stability in Latin America and is crucial for strengthening the ability of the United States to compete in those markets.

The Inter-American Scientific Cooperation Act addresses these issues by creating the Inter-American Scientific Cooperation Program within the National Science Foundation to provide a focus in the United States Government for science and technology cooperation with Latin America. Among the Program's activities will be:

- joint research projects
- scholarly and educational exchanges
- investigation of innovative financing such as "debt-for-science" swaps
- coordination of information exchanges, including computer linkages

- information on access to needed scientific equipment
- promotion of programs which utilize unique natural environments or research facilities.

The Latin American research community is small but vital. Unique natural environments and conditions make Latin America a critical area for research opportunities for U.S. scientists. For example, to thoroughly investigate such topics as the deforestation of the Amazon basin and its contribution to global climate change and species diversity, U.S. scientists need stable working relationships with Latin American scientists and access to these environments. The Inter-American Scientific Cooperation Act will target key projects of this sort for funding by the National Science Foundation.

The bill will also address and help to reverse the downward trend in the number of Latin American students studying in the United States. Since the peak year of 1982, enrollment of Latin American students in U.S. universities has dropped by 31 percent; significant numbers of these students are now traveling to Europe and Japan for advanced study. To help invigorate exchanges between U.S. and Latin American universities, the bill establishes the Inter-American Scientific Educational Fund to provide graduate and post-doctoral fellowships, both for Latin Americans studying in the U.S. and for U.S. students who wish to study in Latin America. These exchanges are investments in our political future. As part of the future leadership in their homelands, these Latin American students will play key roles in determining the political and economic alliances that the region will make in the next century.

If Latin America is to grow out of its debt crisis and its other economic problems, it will be through the vigorous application of science and technology to local conditions. This bill takes a step in that direction, and I urge my colleagues to support it.

The Subcommittee on International Scientific Cooperation will hold a hearing on May 2 to receive testimony on the bill.

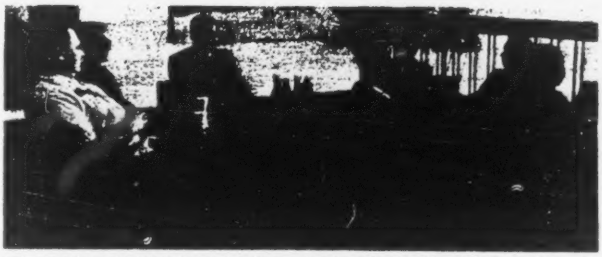
Proposing the Office of Pan American Collaboration

Leon M. Lederman

The Fermi National Accelerator Laboratory (Fermilab) is a large facility—used by physicists from about 80 universities in the US and from about 28 foreign countries—devoted to the study of elementary-particle physics. Its major instrument is a 400-GeV proton accelerator; under construction is a superconducting accelerator designed to raise the energy to 1000 GeV. A very impressive array of advanced technology—developed in the course of accelerator construction and instrumentation development—supports rather exotic basic research into the structure of matter and energy; on a typical day, one can attend seminars on cryogenic developments, microprocessors for information handling, and the interface of quarks and cosmology.

During most of 1980, I corresponded with Latin American physicists concerning collaboration at Fermilab. A hospitality center at Fermilab would be a place where experimental physicists could come to learn an advanced technology and, at same time, pick up some of the excitement of frontier research in particle physics. My objective was to have Fermilab assist and participate in the advance of physics and associated technology in Latin America. The inspiration was clearly the Trieste Center, but my stress is on experimental science and technology. In January of 1981 I attended an international assembly in Bogota and visited the Instituto de Fiscia (UNAM) in Mexico City. It was there, in consultation with Director Jorge Flores, that the idea of a Pan American symposium was born. Funding for the US participation and advice was forthcoming from the NSF's Division of International Programs to supplement my DOE-supported work at Fermilab. The symposium took place in Cocoyoc, Mexico on 5–7 January 1982.

The symposium demonstrated, first of all, that there was a viable Pan American community of high-energy physics. Some ten Latin American countries were represented at the meeting. We were told that this is rare in Latin American physics—that aside from a very strong summer-school program, the last assembly of so many Latin American institutions took place over ten years ago. The meeting had about 50 attendees with strong delegations from the US, Brazil and Mexico. One "quasi" Canadian (Richard Taylor of SLAC) and an informal CERN observer (Georges Charpak) also participated.



Latin American physicists discussing the Pan American Center at Fermilab. From left to right: Miguel Awschalom (Argentina), Jorge Morfin (Mexico), Moyses Kurchnir (Brazil), Carlos Hojvat (Argentina), Juan Bofill (Venezuela) and Ugo Huerta (Mexico).

In addition to reviewing the substance, current status and future expectations of high-energy particle physics, the symposium provided an excellent opportunity to survey the state of physics research and education in Latin America and to explore the possibilities of increased collaboration with US laboratories. One form of collaboration would be to provide assistance to groups interested in becoming users of the high-energy facilities. Another form would be to provide a stimulus to experimentalists in any field of physics who would profit from exposure to the advanced technology associated with high-energy laboratories. Implicit in our objectives is the assumption, perhaps even deep conviction, that a strong physics capability is a necessary component in the potential for technological development.

The following symposium topics were found to be useful for Latin American physicists contemplating collaboration with US high-energy facilities:

Using HEP facilities. Taylor described how users form collaborations, manage their university obligations and carry out research at the remote labs. User groups can be important spurs to local industry in constructing the technically sophisticated devices that users typically bring to the accelerator laboratory. The ICFA (International Committee on Future Accelerators) statement on utilization policy, which has been agreed to by all of the world's HEP laboratory managements, should be known to Latin American scientists. The statement declares that these facilities are open to *all* users on a worldwide basis, the only criteria of selection being scientific merit and technical competence of the proposal. If experimental high-energy physics is deemed to be a useful activity to any institute in the world then the admission fee to any of the world's accelerators is a compelling scientific idea.

Forming a group. Michael Kreisler (University of Massachusetts), who is currently collaborating with Columbia University of Mexico in a BNL/Fermilab experiment, reviewed the requirements for forming a small but viable HEP group. A relevant example has been the Canadian experiment of depending on accelerator facilities abroad to do high-energy physics. This involvement has now developed to the point where the Canadian physicists are interested in the possibility of constructing an electron ring at one of the large proton machines.

Sociology of large teams. The value of working with a large HEP team as an educational experience has pros and cons. On the one hand, working in a well-led group provides opportunities for innovation and opportunities to learn sophisticated technologies. New PhDs in high-energy physics become skilled in these techniques but they also experience the excitement of dealing with data at the frontier of science. On the other hand, there are opportunities for abuse—overly narrow specialization, use of "black box" apparatus and the possible damping of the free

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Leon M. Lederman is director of the Fermi National Accelerator Laboratory, Batavia, Ill.

guest comment

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spirit. However, diligent attention and sensitivity on the part of senior scientists in the group can minimize the possibility of pitfalls and ensure a valuable graduate-student experience.

PhD distribution and production. In terms of scientific manpower there are vast differences between, for example, Brazil (600 PhD physicists in a population of 120 million) and Honduras (3 PhDs in a population of 3 million). For reference, the US has 25 000 PhD physicists in a population of 200 million. This figure may be as good an indicator of development or at least the potential for development as any statistic. Of the roughly 1200 physics PhDs in Latin America, roughly half are active in research. Production of PhDs is roughly 150–200 per year, with more than half being obtained abroad. The population base is 350 million with a total GNP of $500 billion.

Social implications. Michael Moravcsik (University of Oregon) points out that high-energy physics is a central fact of our intellectual age and all who aspire to build up their local universities must participate in it, not only for the scientific prestige associated with achievements but also because the emerging world view is a seminal cultural development. The "grand old man" of Mexican physics, Marcos Moshinsky, said, "Strong physics, with its implied grasp of the basis of technology, is necessary for self-confidence, self-reliance, and ultimately self-sufficiency." Furthermore, the cultural appeal of high-energy physics attracts the most talented people, and they grow to have vast influence outside of their fields of specialization. Bright and versatile practitioners go off and, for example, make contributions to free-electron lasers, apply theoretical tools from high-energy physics to propagation of sound in oceans or apply their accelerator expertise to building tokamaks for nuclear-fusion energy. The application of quantum field theory to condensed-matter physics and particle accelerators to medicine, microelectronics and radiation processing was also noted.

Graduate education itself has social implications for most of Latin America because, in general, it must be done abroad. The trend is away from the US and towards Europe because of the cost and because of the more difficult admission standards of US graduate schools.

Names are important; "Institute" and "Center" do not have the right connotations in Latin America, so we have evolved "Office of Pan American Collaboration" (OPAC).

US interest. The interest of other laboratories in addition to Fermilab is clear: Both SLAC and BNL were represented at the symposium and both are clearly available as hosts to collaboration. If we generalize to include the multipurpose laboratories such as Argonne, then the offering of scientific fare becomes enormous. Fermilab, with pardonable pride, customarily provides facilities for physicists from about thirty countries and is therefore well set up, with housing, a foreign visitor desk, language lessons, counseling and so on. All the laboratories involved in HEP provide science, which is the compelling cultural attraction. The associated technology makes the visit socially redeeming. The Latin American physicists present at the symposium country by country expressed enthusiasm for the prospect of an OPAC.

It is my feeling that we are experiencing something very serious, perhaps historic. If one believes that the technological gap between North and South tends to produce an unstable world, then we are moved to diminish this gap. The profit to the US in taking vigorous leadership is on several levels:

▶ Physicists trained here will use our technology

▶ The human connections forged in this important enterprise must have positive political benefits

▶ An explosion in physics in Latin America will substantially broaden the base out of which, by the usual fluctuations, comes the creative thinker whose breakthroughs will change our lives, increase our comforts or a least preserve the technological society upon which we now depend.

What happens next? Fermilab is already "open" and several theorists have come for short stays. We are shipping donated *Physical Reviews* to libraries in need and are setting up purchasing mechanisms for physics apparatus. We are anxious to receive both physicists and technicians when these visits would benefit the sending institution. We have advised and encouraged the first HEP users group from Mexico. We are seeking modest foundation and international agency support to provide supplementary living costs; private funding minimizes the political complexity of involving governments. Institution-to-institution agreements are simple and should be the rule insofar as this is possible. If, in the course of the next few years, Fermilab and its sister laboratories can play host to 20, 30 or 50 teachers and researchers from Latin America, each of these will in turn touch hundreds of students and colleagues and the leverage will be very great. Being even more optimistic, we can look forward, perhaps in five or ten years, to the serious notion of a Pan American Accelerator Laboratory: a hemispheric Centro Americano de Investigaciones Nucleares. □

HELPING PHYSICS IN LATIN AMERICA

Leon M. Lederman
-and -
Roy Rubinstein

Fermi National Accelerator Laboratory
Batavia, Illinois 60510

Over the past decade or so, we have observed an increase in the attention given to helping science in under-developed countries. This is due in part to the financial difficulties of most of these countries and in part to recognition that a strong scientific infrastructure is a necessity for a country's technological advancement, which in turn in the basis for its economic development. Also, as scientists, we feel that science should strive to use the talents of all having the abilities to contribute to its advancement. This article briefly describes one of the activities carried out by Fermilab, namely the administration of grants to aid Latin American physics. We give this report because the experiences we have gained so far may be valuable to others who are contemplating similar activities. We remark here that administering these grants is just one part of a program Fermilab has for scientific collaboration with Latin America; other aspects of the program could perhaps be the subject of some future article.

The initial idea for these grants arose in discussions at the Second Symposium on Pan American Collaboration in Experimental Physics, held in Rio de Janeiro in July 1983.* Many participants expressed concern at the effects of the economic crisis on the growing scientific infrastructure of the most developed countries in Latin America. It was realized that a relatively small amount of money would be enormously helpful in tiding the physicists in those countries over the difficulties caused by the hard-currency shortages.

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* This Symposium was sponsored by Fermilab (DOE) and the Brasilian Physical Society with support from the NSF.

The eventual result was a $300,000 grant in 1984 from the National Science Foundation (partially funded by the Department of Energy) to the American Physical Society, with principal investigators Lederman and Leo Falicov (University of California, Berkeley). The grant was for assistance to physics in Argentina, Brazil, Chile, Mexico, and Venezuela; it was to be used for library subscriptions to U.S. journals, payment of page charges for articles in U.S. journals, per diem support for Latin American physicists on short visits to the U.S., and spare parts and small equipment items for Latin American physics laboratories. Note that all grant funds were expended in the U.S.

The grant funds were all used by the end of 1986; after much letter writing and pleading, Fermilab was awarded another grant in 1987, this time from the Department of Energy. This grant was for $100,000 and is currently about 70% spent; the purpose and administration is identical to the first one.

The grants were administered essentially by Falicov and Rubinstein, with all activities carried out at Fermilab; no overhead was charged to the grants. In each country, two representatives were chosen to ascertain, in a fair manner, the most critical needs for that country; a strong effort was made to select outstanding members of the physics community in each country, often involving that country's physicists organization. The U.S. administrators, as far as possible, respected the choices of a country's representatives, although items were rejected if they were judged to be not for physics research.

Administering the grants was not without incident; much work was involved but it has led to some understanding of the problems of undertaking research in under-developed countries, and also to lasting friendships with many of the other people involved in this undertaking, who all were taking part not for material reward but for the satisfaction of assisting their fellow physicists. We have many anecdotes (including visitors to U.S with no money phoning and expecting us to instantly supply funds), and have acquired a healthy respect for the often almost incomprehensible and time-dependent regulations for getting scientific equipment past customs departments in the various countries. Dealing with some U.S. companies and persuading them to ship equipment to Latin America was often interesting, to say the least. The reader can perhaps appreciate the labor involved in administering $400,000 worth of grant monies where the typical transaction is about $600; it was truly a labor of love.

To get a feel for the needs of Latin American physicists, it is instructive to look at the requests we have funded; we should make the caveat, however, that the types of requests vary from country to country, and experiences with the current grant are not precisely that with the first one. Nevertheless, for the two grants, the funds have been expended as follows with the current grant figures given in parentheses: per diem expenses 20(10)%, journal subscriptions 20(0)%, page charges 15(25)%, equipment items 45(65)%.

It is obviously of interest to verify the success of these grants in helping to facilitate physics research in Latin America. It is difficult to be quantitative, but we have had many conversations with Latin American physicists describing how their work became possible because of the grants. In addition, when the first grant ran out we received over thirty letters pleading with us to try and obtain a renewal. Some quotes from these are as follows:

> "Acknowledge the help given with the grant that helped us buy spare parts for the CTI helium liquefier." ... "In a country like Chile ... scientific isolation is one of the main problems ... I benefitted from two travel grants ... crucial to establish a long-term collaborative effort on vortex dynamics." "The funds were used to buy pure metals for evaporating purposes, materials which were not available in my country." "Without your help, I would not have been able to buy them, and my studies of fluorite crystals would have been less complete." "To those of us that have used this grant, it represented a way of maintaining our ability to remain competitive in the scientific field."

Our (obviously subjective!) opinion is that the grants have been very valuable in allowing physics research in Latin America that would otherwise not be possible. We hope that our experiences can be useful to others involved in similar projects. The needs for such assistance in Latin America (and presumably in other less-developed countries around the world) is large. The mind boggles at the benefits, long term to science but short term in so far as international amity, that would follow from a one hundredfold multiplication of this project, spread to all scientific disciplines. The cost could soar to 0.2% of our foreign aid.

NEW DIRECTIONS FOR U.S.-LATIN AMERICAN COOPERATION IN SCIENCE AND TECHNOLOGY

FINAL REPORT

June 1988

Technical Note
STPP-TN-3164-4

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SRI Project 3164, Task II-5

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Executive Summary

NEW DIRECTIONS FOR U.S.-LATIN AMERICAN COOPERATION IN SCIENCE AND TECHNOLOGY

Objective and Approach

The 1988 Authorization Acts for the National Science Foundation and NASA directed that NSF work with other federal R&D agencies, including the Department of Energy as well as NASA, in carrying out an independent, interagency study evaluating the effectiveness of mechanisms for hemispheric cooperation in science and technology and suggesting appropriate new action to enhance collaboration in science, space, and technology with Latin America. The study was conducted for the NSF Division of International Programs by the Science and Technology Policy Program of SRI International.

Taking into account other recent or ongoing studies related to S&T cooperation (summarized in the report), this study focused its attention on the identification and assessment of several priority fields in which there were significant opportunities for collaborative efforts of mutual benefit to the United States and Latin American partners. A multidimensional approach, including surveys of researchers involved in cooperative activities, panels of technical experts, quantitative data on R&D infrastructure, resources, and outputs, and analyses of S&T policy formulation, was used to identify opportunities for cooperation in four scientific fields--astronomy, biology, geosciences, and physics/materials science, as well as in engineering. Expert panels convened in each field reviewed survey and other data on the status of Latin American research and existing modes of cooperation, and provided recommendations on ways of improving cooperation in these priority fields. Most of the opportunities identified lie in cooperation with the five most scientifically developed countries--Argentina, Brazil, Chile, Mexico, and Venezuela--but some of the smaller countries in the region offer specific advantages for collaboration in several of the fields (e.g., Costa Rica in tropical biology, Peru in high altitude physics).

The Changing Climate for S&T in Latin America

Latin America is extremely diverse in the size, resources, and level of economic development of individual countries, their environments, cultural heritages, and scientific and technological capabilities. The level of development in the region is such that few countries remain involved in U.S. Agency for International Development programs, but most face serious economic problems, particularly the burden of international debt, that have restricted the resources available for S&T development.

Recent years, however, have seen an increase of science policy and planning agencies in Latin America, as well as an elevation of their national role. Rising enrollments in science and engineering schools and increasing R&D budgets in most of Latin America reflect the critical role that S&T are believed to play in development and economic growth. Private sector involvement in R&D is being encouraged, with multi-sector research parks being established to bring greater interaction between industry, government laboratories, and the universities. New regional patterns of collaboration have emerged. R&D investment levels and research priorities are still more characteristic of developing than industrialized countries, but efforts to place priority on research contributing to technological development are showing their effects. There is strong evidence of increasing S&T activity in the region on the part of European countries and the Japanese.

These important changes have taken place during a period in which the emergence of difficult issues relating to trade, technology transfer, and intellectual property rights appear to have caused a decline in the long tradition of interaction between the United States and Latin America in S&T. Total dollar figures are not available, but eligibility for AID funding has diminished and the number of NSF grants for activities with Latin America flattened out in the mid-1980s. After peaking in 1982/83, the number of Latin American students in the United States has declined by nearly a third. Few fellowships and other forms of financial assistance are available for students wishing to come to the United States for higher education, a marked contrast to the availability of programs offered by

Europe and Japan. Actions such as the 1986 U.S.-Brazil Presidential Initiative in Science and Technology and a strong interest in cooperation on the part of Latin American countries do not appear to have altered this trend.

Priority Fields in Science and Engineering

For astronomy, biology, and the geosciences, cooperation with Latin America is critical to the advancement of the field through access to unique environments, features, or instruments. The importance of southern hemisphere astronomy, Latin American capabilities in space science and remote sensing, environmental concerns, the biodiversity crisis, natural resource problems, and the emergence of earth systems science represent significant overlapping reasons for encouraging collaboration with Latin America in these fields. The other two priority fields identified--engineering, and physics/materials science--represent areas that play an important role in technological development and economic growth.

The study identified significant ongoing cooperation, major centers of activity and evidence of scientific accomplishment in Latin America that represent specific opportunities to build on existing strengths in expanded cooperation. One common ~~theme~~ concerned human resources, pointing to the existence of a sophisticated research community that is underutilized because of a lack of resources, instrumentation, and access to information, and in need of renewal through mid-career training programs and the preparation of a new generation. There was agreement that cooperative efforts would benefit from attention to training through exchanges and graduate-level fellowships, the enhancement of communications (especially computer networks), and access to the literature (both improved publication opportunities and availability of international journals), assistance in instrumentation needs, and the establishment of outreach programs to improve awareness of Latin American activity and U.S. opportunities.

Conclusions and Recommendations

The study concludes that a new climate has emerged for cooperative initiatives with Latin America, one in which S&T is seen as an integral part of the region's efforts to solve its international debt problems, to achieve economic growth and a place in the global economy, and to deal with environmental concerns and the conservation of natural resources. The U.S. response to this climate must resolve some difficult issues. These include the need for additional resources and a solution to the debt problem, striking a balance between bilateral and multilateral modes of action--especially given the diversity of the region, and determination of the best means of responding to the increased hemispheric activity of the European countries and Japan.

The study indicated some particular components that should be considered as part of the U.S. response looking toward future cooperation. The panels identified a number of modes of interaction and mechanisms to enhance human resources, communications, instrumentation, and awareness of opportunities. To the five priority fields examined in the course of the study can be added additional opportunities in biomedical research, energy sources, space research, and a mutual interest in the development of improved indicators of R&D effort and science policy analysis.

A continuing decline in S&T ties between the United States and Latin America will represent a loss of influence with a technical community that will play a significant international role in technologically based industrialization extending far beyond the decade leading to the year 2000. The mutual benefit of immediate scientific progress is but one positive aspect of productive cooperation: of equal or greater importance are the long-term gains in terms of trade, economic growth, political and cultural ties, and national security. Consideration should be given to the creation of a high-level panel or working group, consisting of representatives from U.S. government agencies, private foundations and industry, professional associations, and the S&T policy community to follow through on the recommendations of this report, address issues such as the need for coordination of U.S. efforts in this area, and give direction to the development of initiatives for U.S.-Latin America cooperation that reflect the new realities of S&T in the United States and Latin America.

100th Congress
1st Session | HOUSE OF REPRESENTATIVES | Report 100-110

NATIONAL SCIENCE FOUNDATION AUTHORIZATION ACT FOR FISCAL YEAR 1988

May 28, 1987.—Committed to the Committee of the Whole House on the State of the Union and ordered to be printed

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Mr. Roe, from the Committee on Science, Space, and Technology, submitted the following

REPORT

together with

MINORITY VIEWS AND AN ADDITIONAL VIEW

[To accompany H.R. 2330]

[Including cost estimate of the Congressional Budget Office]

The Committee on Science, Space, and Technology, to whom was referred the bill (H.R. 2330) to authorize appropriations to the National Science Foundation for the fiscal year 1988, and for other purposes, having considered the same, report favorably thereon with amendments and recommend that the bill as amended do pass.

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STUDY ON NEW DIRECTIONS FOR U.S.-LATIN AMERICAN COOPERATION IN SCIENCE AND TECHNOLOGY

Committee View

The National Academy of Sciences' Office on International Affairs, through the Board on Science and Technology for International Development (BOSTID), has received an NRC Program Initiative Fund (PIF) grant in 1987, to explore opportunities for Inter-American cooperation. An initial meeting was held on February 3, 1987, with the federal civilian research and development agencies, and selected professional societies to receive input on agency programs and experiences on science, space, and technology inter-American cooperation. In March, at a second NAS meeting, an ad hoc program planning meeting of scientists was to discuss opportunities for cooperation.

Due to the importance of NSF involvement in international science, the current and future potential opportunities for inter-American cooperation, and the stragetic need for intercoutinental relations, the Committee directs NSF to work with other appropriate federal R&D agencies, including DOE, and NASA, and other independent bodies to chart new directions for U.S.-Latin American cooperation.

The Committee directs that an independent, interagency study of current activities, an evaluation of the effectiveness of different mechanisms for cooperation, and suggestions of appropriate new action, federal and non-federal, to further enhance science, space, and technology intercontinental collaboration, is an appropriate course of action.

Furthermore, a study combining this information should also address why the U.S. should be concerned with scientific cooperation in the hemisphere and which present U.S.-Latin American activities would help further cooperation.

The study should examine opportunities, identify priority countries and fields of action, and recommend, where appropriate, mechanisms—bilateral, multilateral and private which have been effective in the past (providing reason why they were effective), as well as those which have promise in the future.

Not later than June 30, 1988, the Committee requires a final report. The Committee anticipates that funds for this study will come from private sources and the appropriate Federal Government agencies, and would not exceed a total cost of $250,000.

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APPENDIX II

ASSOCIATION OF UNIVERSITIES FOR RESEARCH IN ASTRONOMY, INC.
SUITE 701
1625 MASSACHUSETTS AVENUE, N.W.
WASHINGTON, D.C. 20036
202-483-2101

Goetz K. Oertel
President

May 3, 1989

The Honorable Ralph M. Hall
Chairman
Subcommittee on International
Scientific Cooperation
House Science, Space, and
Technology Committee
U.S. House of Representatives
236 Cannon House Office Building
Washington, D.C. 20515-4304

Dear Chairman Hall:

I am writing at the suggestion of Congressman Sensenbrenner's office to comment on scientific cooperation with Latin America and specifically on the "Inter-American Scientific Cooperation Act of 1989."

AURA, the Association of Universities for Research in Astronomy, is a non-profit corporation which operates national centers including the Cerro Tololo Inter-American Observatory in northern Chile. This world-class facility has served the United States and Latin America well for more than 26 years. We have built upon and extended the record on which I testified before your committee in July 1987. I will not repeat it here.

We would like to do more. Like most of the witnesses before your subcommittee on May 2, 1989, we are constrained by funding rather than by lack of opportunities or the will to cooperate; and we can do a lot more, even with small incremental funds. We also know that the budget is tight and not likely to improve soon.

Individual initiative can help us cope with this dilemma: Congress can help by removing barriers and by creating incentives. Here are examples:

(i) Encourage innovative financing of cooperative projects. For example, debt-swapping can "leverage" US funds for science projects in Latin America. Brazil and Chile are interested in cooperating with the United States in constructing world-class telescopes at Cerro Tololo. As a minimum, the "brick and mortar" and assembly costs could be reduced through debt-swapping because that part of the job would be done in Latin America.

A tax credit or similar incentive for US industry to invest in science projects in Latin America could generate donations. An expression of the will of Congress, such as section 3(3) of H.R. 2152, may also be helpful.

(ii) Promotion of research programs which utilize unique natural environments or existing centers of research excellence in Latin America (section 3(6) of H.R. 2152) makes good sense. My bias may be showing through: A good part of the universe can be seen only from the southern hemisphere; only Chile has superb sites; and Cerro Tololo Inter-American Observatory is a world-renowned center of excellence! At the risk of being immodest, Mr. Chairman, I suggest that you consider citing Cerro Tololo as an example in section 3(6).

Section 3(6) as written (April 24, 1989) is a helpful expression of the will of Congress. When budgets are tight, agencies can ignore such expressions unless funds are earmarked for that purpose. If Congress does so, however, it can get too deeply into details and effectively take over management. Congress could, instead, motivate agencies by requiring annual reports (Section 4 of H.R. 2152). Nobody likes to report that little or nothing was done!

(iii) Congress could encourage and promote personal initiative. It could establish a prestigious award to recognize people and institutions for fostering inter-American science.

Mr. Chairman, we at AURA applaud and appreciate your efforts on behalf of inter-American science.

Sincerely yours,

Goetz K. Oertel

Goetz Oertel

cc: Honorable Ron Packard,
Ranking Minority Member